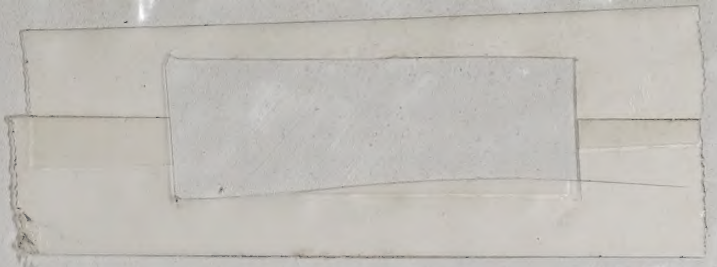

RADIO

&

R F

Advanced Receiver Research

Installation Guidelines for ARR GaAsFET Preamplifiers

GaAsFET preamplifiers offer significant improvements in noise figure, gain, 1 dB compression and 3rd order intercept characteristics over bipolar, JFET and dual-gate MOSFET types. Preamplifiers utilizing GaAsFET devices require some special care in installation not normally associated with the other types. GaAsFETs are designed for microwave use so the internal structural dimensions are extremely small, therefore operating and breakdown voltages are considerably lower. Additionally, the GaAsFET device contains no internal protection such as back-to-back, gate-source diodes as used in dual-gate MOSFETs. For these reasons, the GaAsFET preamplifiers are more easily damaged than bipolar, JFET or dual-gate MOSFET types. Nevertheless, properly installed preamplifiers will provide years of trouble free operation.

ARR GaAsFET preamplifiers have built-in protection against:

(1) normal static buildup at input. ARR GaAsFET preamplifiers incorporate a resistive bleeder for normal wind, rain and snow static plus reasonable lightning charge buildup. This bleeder is not capable of protecting against extremely close or direct lightning strikes. If the preamplifier is to be installed in a particularly harsh environment, some form of external static protection device may be necessary.

(2) reverse power supply voltage.

(3) power supply transients. All GaAsFET preamplifiers use an onboard power conditioning circuit to provide the GaAsFET device with a clean and stable supply voltage.

The built-in protection circuitry eliminates many of the problems encountered with GaAsFET preamplifiers. Other potential problems may exist in certain installations and it is the installer's responsibility to ensure against them. Two areas of concern apply to all installations:

(1) difference in ground potential between power supply, input and output connections. Verify that the dc power source ground and the preamplifier input and output coaxial cables (shields) are all at the same ac and dc potential before installing the preamplifier in the system. This test is easily and quickly performed with a VOM or similar instrument. A check should also be performed before installing the preamplifier in a bench test setup for performance verification. Leakage currents from older test equipment can damage GaAsFET preamplifiers. Always use a ground lead between the dc supply ground and the case (ground lug) of the preamplifier. Do not rely on the coaxial cable shields for an adequate ground.

(2) use a crowbar protected power source. The ARR GaAsFET preamplifier is capable of withstanding power supply surges to 40 vdc. Some dc supplies can produce voltages in excess of this value should regulator or pass transistor failure occur. Crowbar protected power supplies will limit the output voltage to some predetermined level usually below this value.

GaAsFET Preamplifiers in Repeater Service

Preamplifiers placed in service on some repeaters may be subjected to certain potentially destructive conditions. Since repeaters are quite often located in harsh environments, area lightning, wind, rain and snow static can cause device failure. This problem is normally eliminated through the use of a bandpass/band reject type duplexer rather than the plain band reject type. The bandpass cavity of a bandpass/band reject duplexer allows the input of the preamplifier to see only a narrow window of the spectrum centered on the receive frequency. Potentially harmful static buildup at all other frequencies is shunted to ground in the cavity, effectively eliminating the problem. Use of a plain band reject type of duplexer produces quite a different effect. When cavities are used only in the reject mode, the preamplifier sees the entire radio spectrum except for the narrow window centered on the transmitter frequency. The bandwidth over which the destructive voltage can build up is tremendously greater for the plain band reject duplexer. For systems already using a band reject duplexer the addition of a single bandpass cavity will provide the appropriate protection. An additional bonus in using a bandpass/band reject duplexer system is that possible interference causing out-of-band signals are eliminated.

GaAsFET Preamplifiers in Transceive Systems

When using tower mounted or indoor preamplifiers in a transceive system, coaxial relays must be used to switch the preamplifier out of the line during transmit periods. Several relay configurations are possible and the system depicted in Fig. 1 is the simplest, most commonly used and, unfortunately, the most likely to cause preamplifier failure. In this case a voltage

from the transceiver is used to activate the coaxial relays during transmit to remove the preamplifier from the circuit. The problem with this system is that a finite amount of time is required for the relay arm to change position. Most relays have actuation times of 25 milliseconds or more. At the moment the transmitter is keyed, rf power from the transmitter is applied to the output of the preamplifier until the relay has time to break the circuit. In many cases, bipolar, JFET and dual-gate MOSFET devices are able to handle this short burst of power. GaAsFETs will not. This system can be made to function by using appropriate relay sequencing. RL1 and RL2 should be activated immediately upon transmit, with an ordinary dc relay (or suitable solid-state circuit) introducing an appropriate time lag before unbiasing the power amplifier. Operated in this manner, RL1 and RL2 will have time to switch before rf power flows through them.

The best system for preamplifier control consists of one coaxial relay and separate transmit and receive feedlines as outlined in Fig. 2. In this system the preamplifier output is connected to the receiver input at all times. Under no circumstances can transmitter rf power be applied to the preamplifier. RG-8 or similar cable may be used for the receive feedline, as loss in this line does not significantly affect noise figure. As shown, the coaxial relay is normally in the transmit position and therefore the preamplifier is automatically taken out of the line when the station is shut down. This arrangement protects the preamplifier from damage caused by nearby lightning strikes when the station is not in use. A separate receiver input connection is required with this system so minor modifications may have to be made to transceivers that do not have this option.

The coaxial relays chosen for use should have adequate isolation for the transmitter power level. Minimum acceptable levels are as follows:

Transmitter Power	Relay Isolation
10 W	40 dB
20 W	43 dB
100 W	50 dB
200 W	53 dB
400 W	56 dB
800 W	59 dB
1600 W	62 dB

When in doubt about a particular relay always measure the isolation before installing it in the system.

Preamplifiers Mounted Within Transceivers

ARR supplies preamplifiers without case and connectors for mounting within transceivers. Preamplifiers are normally wired between the transceiver antenna transmit/receive relay (or PIN diode switching) and the input to the existing receiver. The same precautions outlined in the previous section, relay sequencing and relay isolation, apply.

NOTE: Never install a preamplifier directly to a transceiver antenna terminal even for receive only or test purposes. Most transceivers, even with microphone and key removed cycle through the transmit mode briefly during initial power up. This instant of transmitter power is sufficient to cause preamplifier failure. Powering up the transceiver first and then connecting the preamplifier may alleviate the initial power up problem. However, should the power main or transceiver dc supply drop momentarily the transceiver power up problem will occur.

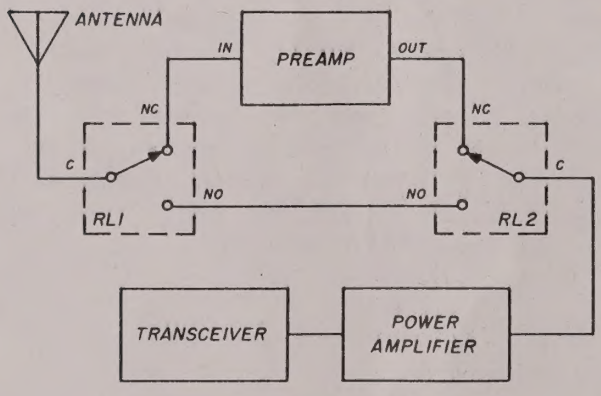

Fig. 1

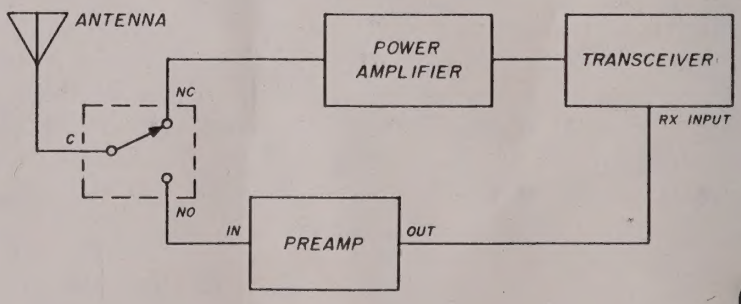

Fig. 2

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Advanced Receiver Research

INSTRUCTION SHEET

P28VDG
P50VDG
P136VDG
P144VDG
P220VDG
P432VDG

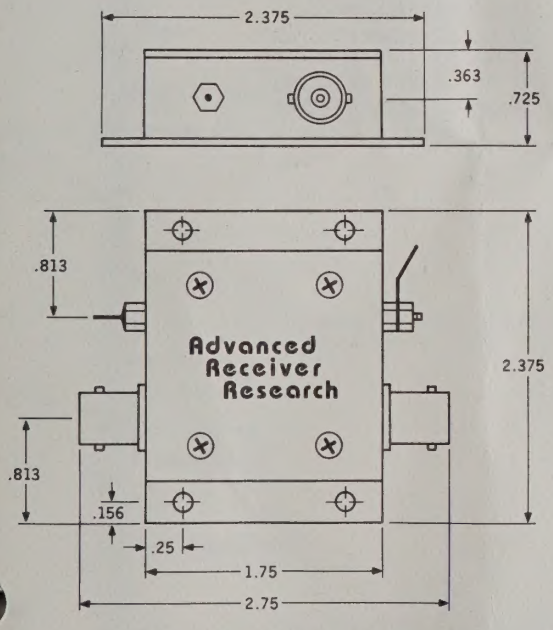
Series PXXXVDG preamplifiers have been specifically designed for amateur use. Each unit is housed in a completely shielded, rugged, custom aluminum enclosure. To maintain a high degree of rf shielding a feedthrough-type capacitor is used for the dc connection. A solder-lug terminal opposite the feedthrough capacitor is provided for the dc ground connection. Each and every preamplifier has been precision aligned on our noise figure measuring equipment and should not need further adjustment.

The PXXXVDG preamplifiers are suitable for fixed, mobile or portable operation. Power supply requirements are 10-16 Vdc at 15 mA. Small size, low power consumption and rugged construction make these preamplifiers ideal for installation within existing equipment or remote mounting at the antenna.

Theory and Operation

Signals arriving at the input terminal are routed to the gate of the GaAsFET through an L network. The source of the device is held above ground by R1 which develops the appropriate gate-source voltage. Two .01 uF capacitors ground the source for rf. A broadband ferrite transformer is used to match the drain circuit and provide a low impedance load for the GaAsFET. The positive supply line is passed through a .001 uF feedthrough capacitor to maintain effective shielding. A series diode protects the preamplifier against accidental application of reverse polarity voltage. An MC78L05 provides a regulated 5 volt supply for the GaAsFET and protects the device from power supply transients.

Interconnection to a receiver or converter is quite straightforward. A coaxial cable is used to connect the output of the preamplifier (labeled "out") to the receiver or converter antenna terminal. The antenna is connected to the preamplifier input terminal (labeled "in"). A power supply capable of delivering proper voltage and current is connected to the lugs marked "vdc" and "gnd." Vdc is positive and gnd is negative. Each preamplifier is specified for operation over the temperature range −25 to +65° C.



Specifications

Model	*Bandwidth (1 dB)*	*Noise Figure*	*Gain*	*Compression (1 dB)*
P28VDG	2 MHz	<0.5 dB	24 dB	+ 12 dBm
P50VDG	4 MHz	<0.5 dB	24 dB	+ 12 dBm
P136VDG	7 MHz	<0.5 dB	24 dB	+ 12 dBm
P144VDG	7 MHz	<0.5 dB	24 dB	+ 12 dBm
P220VDG	12 MHz	<0.5 dB	20 dB	+ 12 dBm
P432VDG	40 MHz	<0.5 dB	16 dB	+ 12 dBm

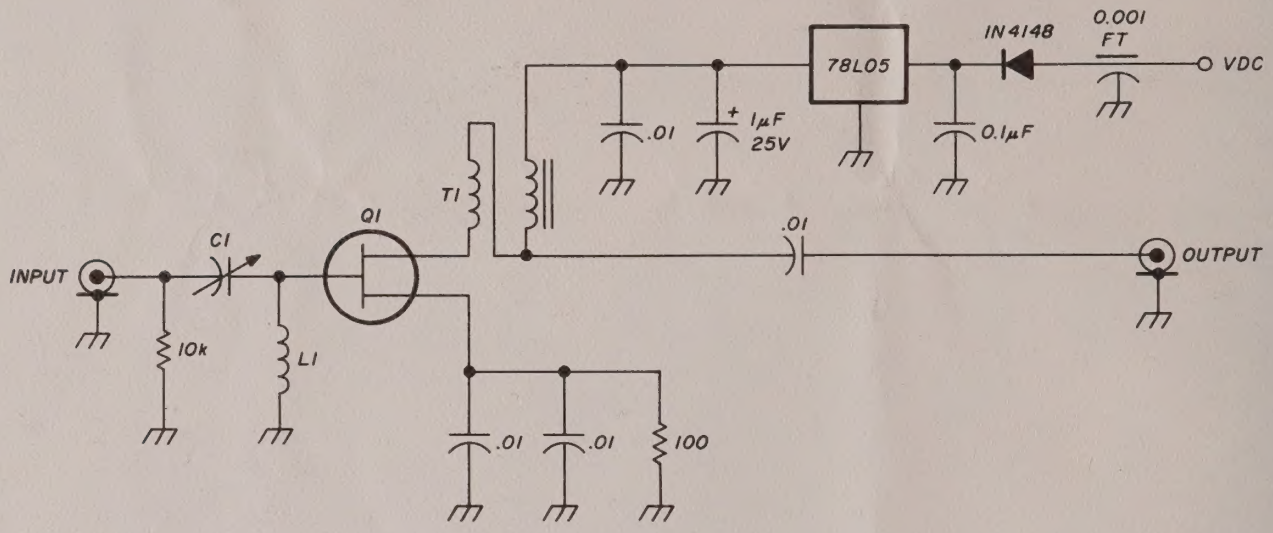
Supply voltage: 10-16 Vdc
Supply current: 15 mA
Weight: 2.0 oz.

Box 1242 Burlington, CT 06013 (203) 582-9409

Warranty

All Advanced Receiver Research products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery. We will repair or replace products which prove to be defective during the warranty period provided they are returned to Advanced Receiver Research. Shipment should not be made without prior authorization by Advanced Receiver Research. No other warranties are expressed or implied. We are not liable for consequential damages.

This warranty does not apply to any product repaired or altered by persons not authorized by Advanced Receiver Research, or not in accordance with instructions furnished by Advanced Receiver Research. If the unit is found to be defective as a result of misuse, improper repair, or abnormal conditions of operation, repairs will be billed at cost.



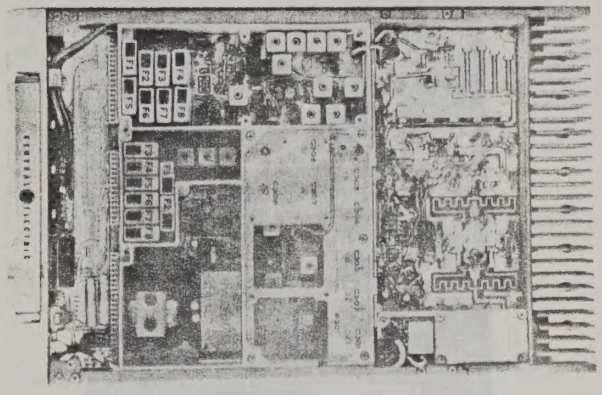
Model	C1	L1	T1
P28VDG	20 pF	25T No. 30 T-25-10	8T No. 32 bifilar FT-23-101
P50VDG	20 pF	21T No. 30 T-25-12	16T No. 32 bifilar FT-23-61
P136VDG	5 pF	7T No. 20 0.3125 dia.	15T No. 32 bifilar FT-23-63
P144VDG	5 pF	6T No. 20 0.3125 dia.	15T No. 32 bifilar FT-23-63
P220VDG	5 pF	5T No. 20 0.250 dia.	11T No. 32 bifilar FT-23-63
P432VDG	5 pF	3T No. 20 0.125 dia.	5T No. 32 bifilar FT-23-63

All Models
Q1 MGF1302

MOBILE RADIO

MASTR II
MAINTENANCE MANUAL

& 450-512 MHz, 40-WATT TRANSMITTER



Maintenance Manual LBI-4622B

40-WATT PA ASSEMBLY 19C320620G5-8

FICATIONS *

put	
-420 MHz & 450-470 MHz	40 Watts (Adjustable from 12 to 40 Watts)
-494 MHz	38 Watts (Adjustable from 12 to 38 Watts)
-512 MHz	35 Watts (Adjustable from 12 to 35 Watts)
ultiplication Factor	36
Stability	
-ICOM with EC-ICOM	±0.0005% (-40°C to +70°C)
-ICOM or EC-ICOM	±0.0002% (0°C to +55°C)
-ICOMS	±0.0002% (-40°C to +70°C)
and Harmonic Emission	At least 80 dB below full rated power output.
ion	Adjustable from 0 to ±5 kHz swing with instantaneous modulation limiting.
ion Sensitivity	75 to 120 Millivolts
Frequency Characteristics	Within +1 dB to -3 dB of a 6-dB/octave pre-emphasis from 300 to 3000 Hz per EIA standards. Post limiter filter per FCC and EIA.
ion	Less than 2% (1000 Hz) Less than 3% (300 to 3000 Hz)
Symmetry	0.5 kHz maximum

Frequency Spread (2 to 8 channels)	Full Specifications	1 dB Degradation
-420 MHz	2.75 MHz	6.00 MHz
-470 MHz	2.75 MHz	9.00 MHz
-494 MHz	2.90 MHz	9.50 MHz
-512 MHz	3.00 MHz	9.75 MHz

le	EIA 20% Intermittent
ut Impedance	50 Ohms

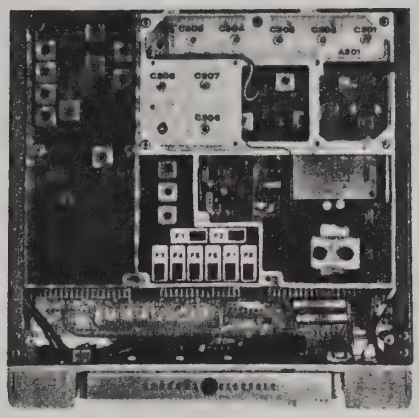
ons are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

GENERAL ELECTRIC

MOBILE RADIO

MASTR II MAINTENANCE MANUAL

406-420 & 450-512 MHz RECEIVER



Maintenance Manual LBI-4627A
(Superseded by LBI-30025)

19C320529G1 RECEIVER RF ASM 19D417075G1-4

SPECIFICATIONS *

Audio Output (to 8-ohm Speaker)	12 Watts at less than 3% distortion	
	Standard Receiver	Ultra-High Sensitivity Receiver
Sensitivity		
12-dB SINAD (EIA Method)	0.35 µV	0.20 µV
20-dB Quieting Method	0.50 µV	0.25 µV
SELECTIVITY		
EIA Two-Signal Method	-90 dB	-90 dB
20-dB Quieting Method	-100 dB	
Spurious Response	-100 dB	-90 dB
Intermodulation (EIA)	-80 dB	-75 dB
Squelch Sensitivity		
Critical Squelch	0.2 µV	0.1 µV
Maximum Squelch	Greater than 20 dB quieting (less than 1.5 µV)	
Frequency Stability		
5C-ICOM with EC-ICOM	±0.0005% (-40°C to +70°C)	
5C-ICOM or EC-ICOM	±0.0002% (0°C to +55°C)	
2C-ICOMS	±0.0002% (-40°C to +70°C)	
Modulation Acceptance	±7 kHz (narrow-band)	

Maximum Frequency Separation (Multi-Frequency Units)	Full Specifications	3dB Degradation
406 - 470 MHz	1.60 MHz	2.0 MHz
470 - 494 MHz	1.80 MHz	2.30 MHz
494 - 512 MHz	1.50 MHz	2.0 MHz

Frequency Response	Within +1 and -8 dB of a standard 6-dB per octave de-emphasis curve from 300 to 3000 Hz (1000-Hz reference)
RF Input Impedance	50 ohms

* specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

GENERAL ELECTRIC

TRANSMITTER TYPE NUMBERS

STANDARD TRANSMITTER	FREQ. RANGE (MHz)	NUMBER OF FREQS.	FREQ. STABILITY	POWER OUTPUT (Watts)
KT-70-A	25-50	1 thru 8	±0.0005%	50
KT-70-C	25-50	1 thru 8	±0.0002%	50
KT-71-A	25-50	"	±0.0005%	100
KT-71-C	25-50	"	±0.0002%	100
KT-72-A	138-174	"	±0.0005%	35
KT-72-C	138-174	"	±0.0002%	35
KT-73-A	138-174	"	±0.0005%	65
KT-73-C	138-174	"	±0.0002%	65
KT-74-A	138-174	"	±0.0005%	110
KT-74-C	138-174	"	±0.0002%	110
KT-76-A	450-512	"	±0.0005%	40 (450-470 MHz) 35 (494-512 MHz) 38 (470-494 MHz)
KT-76-C	450-512	"	±0.0002%	40 (450-470 MHz) 38 (470-494 MHz) 35 (494-512 MHz)

WIDE-SPACED TRANSMITTER	FREQ. RANGE (MHz)	NUMBER OF FREQ.	FREQ. STABILITY	POWER OUTPUT (Watts)
KT-90-A	30-50	1 thru 8	±0.0005%	50
KT-90-C	30-50	"	±0.0002%	50
KT-91-A	30-50	"	±0.0005%	100
KT-91-C	30-50	"	±0.0002%	100
KT-92-A*	138-174	"	±0.0005%	35
KT-92-C*	138-174	"	±0.0002%	35
KT-93-A*	138-174	"	±0.0005%	65
KT-93-C*	138-174	"	±0.0002%	65
KT-94-A*	138-174	"	±0.0005%	110
KT-94-C*	138-174	"	±0.0002%	110
KT-96-A	450-512	"	±0.0005%	40 (450-470 MHz) 38 (470-494 MHz) 35 (494-512 MHz)
KT-96-C	450-512	"	±0.0002%	40 (450-470 MHz) 38 (470-494 MHz) 35 (494-512 MHz)

TRANSMITTER WITH CONVERTER		FREQ. RANGE (MHz)	NUMBER OF FREQS.	FREQ. STABILITY	POWER OUTPUT (Watts)
STANDARD	WIDE-SPACED				
KT-70-E	KT-90-E	25-50	1 thru 8	±0.0005%	50
KT-70-G	KT-90-G	25-50	1 thru 8	±0.0002%	50
KT-72-E	KT-92-E	138-174	"	±0.0005%	35
KT-72-G	KT-92-G*	138-174	"	±0.0002%	35
KT-73-E	KT-93-E*	138-174	"	±0.0005%	65
KT-73-G	KT-93-G*	138-174	"	±0.0002%	65
KT-76-E	KT-96-E	450-512	"	±0.0005%	40
KT-76-G	KT-96-G	450-512	"	±0.0002%	40 (450-470 MHz) 38 (470-494 MHz) 35 (494-512 MHz)

* Second exciter will be in the 150.8-174 MHz range.

MODIFICATIONS

The standard duplex mobile radio combination was modified for "Dual Receiver" operation by incorporation of the following changes:

1. Hinged assembly 19B219927G1 was replaced with hinged assembly 19D417637G1.

2. The 19B226113G1 Cable harness was replaced with a special cable harness and was wired as shown on Wiring Diagram 19R601095. This cable connects the Duplex harness board and Panel (19B226255G1) to the Radio System board.

3. The 19D417638G1 10 Volt Regulator board was modified by changing capacitor C906 from a 19C300075P15001J (0.015 μF) to a 5496267P13 (2.2 μF) also, a 13 K resistor (R904) 3R152P133J was added in parallel with C906 as shown on Wiring Diagram 19R601095.

4. The 19C321056P3 Duplexer was replaced with Power Splitter 19C317352G1. RF connections to the Power Splitter are shown on Wiring Diagram 19R601095. Cables utilized to make these connections are shown in the following illustration:

5. Receiver No. 1 IFAS board (19D416606G1) was added in place of Connector Board 19B226347G1. Connections are made to J904 on the System Board.

6. The Printed Wire Pattern between H68 and J904-9 on the Systems board was cut and a DA wire was added between H67 and H68. This wiring change allows the RUS (Receiver Unsquelched Sensor) output to operate the associated RUS No. 1 or RUS No. 2 indicators on the control unit.

Pushbutton Switches

Frequency selection (R1 thru R4) in Receiver No. 1 (top unit) is achieved with the pushbutton frequency select switches (S701B thru S701E) on the Control Unit front panel. Frequency R3, provided by Receiver No. 2 (Bottom Unit) is strapped permanently for single frequency operation.

All pushbutton switches, except the Black ON-OFF switch, are interlocked to prevent simultaneous selection. The pushbutton indicators normally illuminate at reduced brilliance when not selected (not depressed). When selected, the pushbutton indicator will glow at full brilliance.

Frequency select switch functions are as follows:

PushButton	TX	RX NO. 1	RX NO. 2
Black (ON/OFF)			
Blue	T1	R1	R3 (F5 position)
Yellow	T2	R2	R3 (F5 position)
Red	T3	R3	Muted
White	T4	R3	Muted

DAY-OFF-DIM Switch S702

Switch S702 provides a means of selecting either full brilliance (DAY), reduced brilliance (DIM) or disabling the indicators (OFF). When S702 is in the DAY position, A+ is applied to the TX indicator and the RUS No. 1 and RUS No. 2 indicators (LED's). When S702 is in the DIM position, the LED dimmer circuit (Q703 and Q704) is connected between the indicators and A+. Potentiometer R722 can be adjusted to control the LED dim level of the TX, RUS No. 1 and RUS No. 2 indicators.

RUS No. 1 and RUS No. 2 Indicators

The RUS indicators (CR712 and CR713) when illuminated, indicate that the associated receiver is unsquelched, resulting from either the squelch control not being adjusted properly or the receiver has been unsquelched by a proper received signal.

Transistor switch Q701 and Q702 control the RUS indicators. When a receiver is unsquelched the RUS output of the receiver will go to approximately +5 Volts. This voltage turns on Q701 or Q702, depending upon which receiver is unsquelched, applying A+ to the associated LED (RUS No. 1 or RUS No. 2).

NOTE

When the receiver squelch control in Channel Guard receivers is adjusted properly, the receiver's RUS output will operate only when a proper Channel Guard Signal is received.

CONTROL CABLE 19D423424G 1+1

The standard control cable has been replaced with special control cable ~~19D423385G1~~. This cable allows dual receiver operation by providing the control functions required for two independent receivers. These include frequency selection for Receiver No. 1 only (Receiver No. 2 is single frequency receive), separate Volume and squelch controls connections for each receiver, Channel Guard Monitor and Receiver Mute functions for each receiver and two separate speaker high and low outputs.

Control Cable plugs P702 and P703 connect to J761 and J762, respectively, on the Control Unit. Plug P901 connects to J901, also on the Control Unit. Refer to Control Cable Wiring Diagram 19C321709 and Outline Diagram 19D423385 for details.

OPERATION

Frequency Selection

Control Unit frequency selection is as follows:

ICOM POSITION	TRANSMIT CH. GD. = 82.5 Hz	RECEIVER NO. 1 (TOP) CH. GD. = 82.5 Hz	RECEIVER NO. 2 (BOTTOM) CH. GD. = 82.5 Hz
F1	465.150 MHz (EC ICOM)	460.150 MHz (5C ICOM)	
F2	465.475 MHz (EC ICOM)	460.475 MHz (EC ICOM)	
F3	465.050 MHz (EC ICOM)	460.050 MHz (EC ICOM)	
F4	460.050 MHz (EC ICOM)	460.050 MHz (Repeating ICOM from F3)	
F5	-	- - - - -	460.050 MHz (5C HiSide Inj. ICOM, Single Freq Strapped on Receive R3 Freq.

R55

DESCRIPTION

MASTR II mobile radio combinations are compact, highly reliable and ruggedly-constructed units that are designed to meet the most strigent requirements in the two-way radio field.

The radios are fully transistorized-utilizing both discrete components and Integrated Circuits (IC'S) for highest reliability. Since no tubes are used, the radio is ready to use the instant it is turned on. The standard combination may be equipped with the following:

- One through eight frequencies
- Plug-in oscillators for ±0.0002% or ±0.0005% oscillator stability
- Channel Guard (tone squelch)
- Noise Blanker (25-50 and 138-174 MHz)
- Ultra High Sensitivity (UHS) preamplifier (138-174 and 406-512 MHz)
- DC Converter

The radio set is housed in a drip-proof case only five inches high. The radio mounts to the vehicle by a bottom mounting plate, and is tamper-proof when locked into the mounting plate. When unlocked, the handle can be pulled down and the radio pulled out of the mounting plate or the top cover removed for servicing. When the handle is pulled down 90 degrees, the radio can be locked to hold the handle in the carrying position.

A hinged bottom section provides space for mounting a Dual Front End, a second exciter board for Wide-Spaced Transmitters, or other modules.

To gain access to the modules in the bottom section, remove the radio from its mounting frame and turn the radio over. Then loosen the two captive screws securing the bottom cover and remove the cover (see Figure 1).

The bottom section swings open so that all major modules and tuning adjustments in the radio are easily accessible for servicing. To swing the bottom section open, first remove the bottom cover. Next, loosen the screw in the retaining latch and slide the latch open. The bottom section will now swing open as shown in Figure 2.

No power supply is required since the highest supply voltage used in the radio is derived from the vehicle battery.

Centralized metering jacks for the transmitter, receiver and system board are provided for simplified alignment and troubleshooting.

Figure 1 - Typical Bottom Section Module Layout

Figure 2 - Typical Top Section Module Layout (Bottom Section Swing Open)

Both the transmitter, receiver and option modules are electrically isolated from the radio chassis to permit operating in positive or negative gound vehicles without the use of a polarity converter. The transmitter exciter and receiver modules are mounted in a Lexan® frame for isolation. In 12-Volt systems, simply changing four connections to the control unit and reversing the power leads at the fuse block allows the radio to be used in negative or positive ground vehicles. No changes are required in the radio.

TRANSMITTER

The transmitter consists of an exciter board located in the mounting frame, and a power amplifier assembly. The PA assembly consists of a PA board mounded on a PA casting at the rear of the radio. A hermetically sealed antenna switch is also mounted on the PA assembly.

RECEIVER

The receiver consists of an oscillator/multiplier assembly (Osc/Mult), RF assembly, mixer/IF assembly (MIF), and IF-audio and squelch assembly (IFAS). In receivers with Noise Blankers, the noise blanker circuit replaces the standard MIF board. In UHS receivers, the pre-amplifier mounts in the area near the antenna input board.

DC CONVERTER

For systems that operate between a minimum of 16 Volts DC and a maximum of 60 Volts DC (i.e., nominal 24-Volt, 36-Volt or 48-Volt systems), a DC converter mounts at the rear of the radio under the transmitter PA assembly. The converter supplies all power to the radio, and no changes are required in the power leads on the radio for positive or negative ground operation.

CONTROL UNIT

The control unit contains the power on-off rocker switch, volume and squelch controls, channel selector switch in multi-frequency models, a red transmit indicator light and a power on/frequency indicator light. Space is provided for an optionsl rocker switch, and two optional indicator lights.

The control unit is enclosed in a two piece molded Lexan® housing, and is supplied with a Lexan® mounting bracket and Safety Release assembly. The Safety Release assembly breaks away under the impact for passenger safety. This mounting assembly also permits the control unit to be swiveled as desired for the convenience of the operator.

Two or three connectors are located on the rear of the control unit, depending on the type of control unit used. Two of

DESCRIPTION

MASTR II transmitters are crystal-controlled, phase modulated transmitters designed for one through eight-frequency operation in the 406 to 420 and 450 to 512 megahertz band. The solid state transmitter utilizes both integrated circuits (ICs) and discrete components, and consists of the following assemblies:

Exciter Board; with audio, modulator, amplifier and multiplier stages

Power Amplifier Assembly; with amplifier, driver, PA, power control, filter and antenna switch.

CIRCUIT ANALYSIS

EXCITER

The exciter uses seven transistors and one integrated circuit to drive the PA assembly. The exciter can be equipped with up to eight Integrated Circuit Oscillator Modules (ICOMs). The ICOM crystal frequency ranges from approximately 11.3 to 14.2 megahertz, and the crystal frequency is multiplied 36 times.

Audio, supply voltages and control functions are connected from the system board to the exciter board through P902.

Centralized metering jack J103 is provided fro use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12. The test set meters the modulator, multiplier and amplifier stages, and the regulated 10-Volts.

ICOMS

Three different types of ICOMs are available for use in the exciter. Each of the ICOMs contains a crystal-controlled Colpitts oscillator, and two of the ICOMs contain compensator ICs. The different ICOMs are:

5C-ICOM - contains an oscillator and a 5 part-per-million (±0.0005%) compensator IC. Provides compensation for EC-ICOMs.

EC-ICOM - contains an oscillator only. Requires external compensation from a 5C-ICOM.

2C-ICOM - contains an oscillator only. 2 PPM (±0.0002%) compensator IC. Will not provide compensation for an EC-ICOM.

The ICOMs are enclosed in an RF shielded can with the type ICOM (5C-ICOM, EC-ICOM or 2C-ICOM) printed on the top of the can. Access to the oscillator trimmer is obtained by prying up the plastic tab on the top of the can. The tabs can also be used to pull the ICOMs out of the radio.

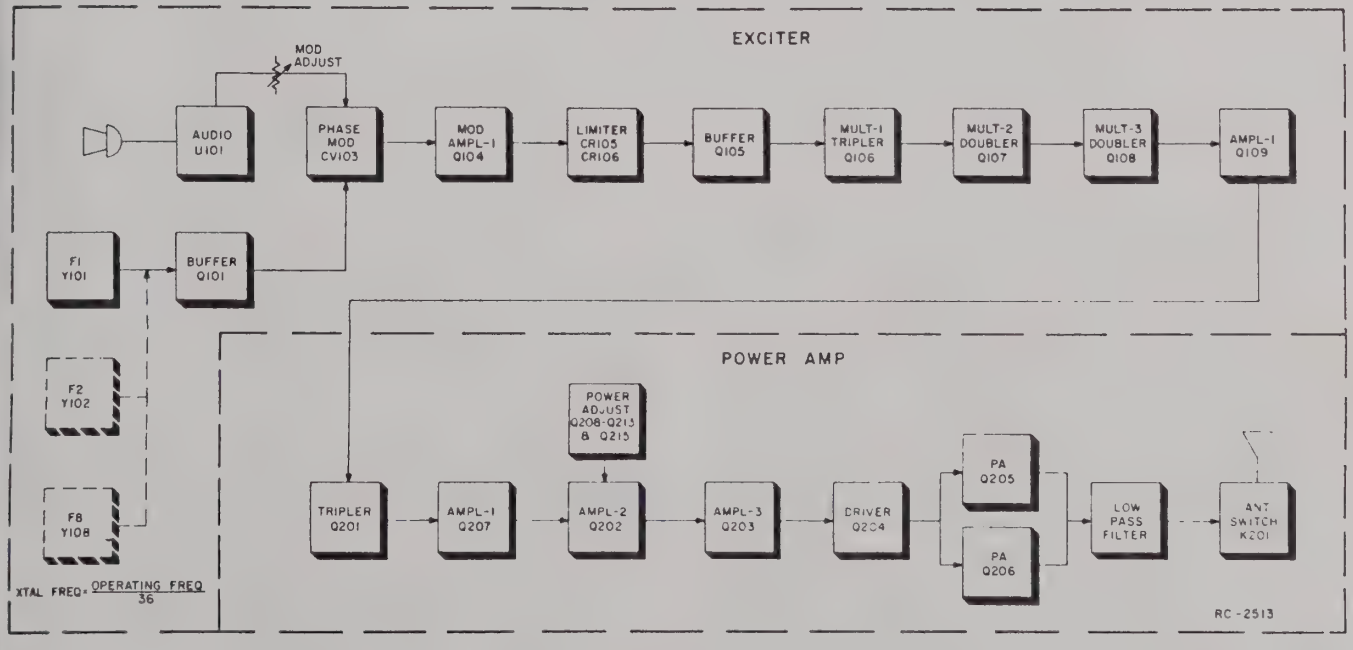


Figure 1 - Transmitter Block Diagram

Frequency selection is accomplished by switching the ICOM keying lead (terminal 6) to A- by means of the frequency selector switch on the control unit. In single-frequency radios, a jumper from H9 to H10 in the control unit connects terminal 6 of the ICOM to A-. The oscillator is turned on by applying a keyed +10 Volts to the external oscillator load resistor.

CAUTION

All ICOMs are individually compensated at the factory and cannot be repaired in the field. Any attempt to repair or change an ICOM frequency will void the warranty.

In Standard 5 PPM radios using EX-ICOMs, at least one 5C-ICOM must be used. The 5C-ICOM is normally used in the receiver F1 position, but can be used in any transmit or receive position. One 5C-ICOM can provide compensation for up to 15 EC-ICOMs in the transmit and receiver. Should the 5C-ICOM compensator fail in the open mode, the EC-ICOMs will still maintain 2 PPM frequency stability from 0°C to 55°C (+32°F to 131°F) due to the regulated compensation voltage (5 Volts) from the 10-Volt regulator IC. If desired, up to 16 5C-ICOMs may be used in the radio.

The 2C-ICOMs are self-compensated at 2 PPM and will not provide compensation for EC-ICOMs.

Oscillator Circuit

The quartz crystals used in ICOMs exhibit the traditional "S" curve characteristics of output frequency versus operating temperature.

At both the coldest and hottest temperatures, the frequency increases with increasing temperature. In the middle termperature range (approximately 0°C to 55°C), frequency decreases with increasing temperature.

Since the rate of change is nearly linear over the mid-temperature range, the output frequency change can be compensated by choosing a parallel compensation capacitor with a temperature coefficient approximately equal and opposite that of the crystal.

Figure 2 shows the typical performance of an uncompensated crystal as well as the typical performance of a crystal which has been matched with a properly chosen compensation capacitor.

At temperatures above and below the mid-range, additional compensation must be introduced. An externally generated compensation voltage is applied to a varactor (voltage-variable capacitor) which is in parallel with the crystal.

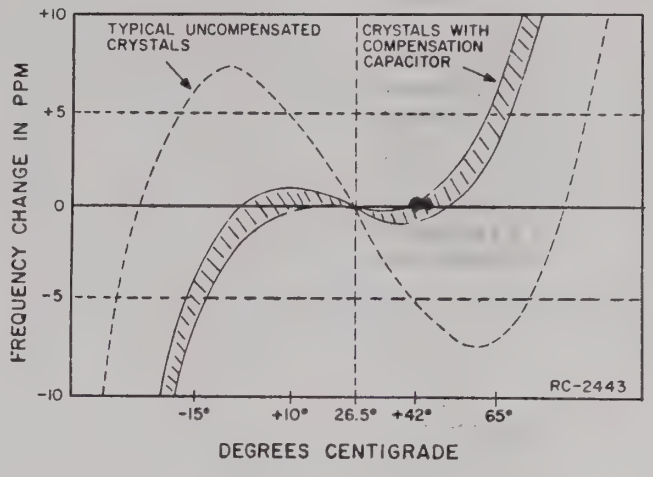


Figure 2 - Typical Crystal Characteristics

A constant bias of 5 Volts (provided from Regulator IC U901 in parallel with the compensator) establishes the varactor capacity at a constant value over the entire mid-temperature range. With no additional compensation, all of the oscillators will provide 2 PPM frequency stability from 0°C to 55°C (+32°F to 131°F).

Compensator Circuits

Both the 5C-ICOMs and 2C-ICOMs are temperature compensated at both ends of the temperature range to provide instant frequency compensation. An equivalent ICOM circuit is shown in Figure 3.

The cold end compensation circuit does not operate at temperatures above 0°C. When the temperature drops below 0°C, the circuit is activated. As the temperature decreases, the equivalent resistance decreases and the compensation voltage increases.

The increase in compensation voltage decreases the capacity of the varactor in the oscillator, increasing the output frequency of the ICOM.

The hot end compensation circuit does not operate at temperatures below +55°C. When the temperature rises above +55°C, the circuit is activated. As the temperature increases, the equivalent resistance decreases and the compensation voltage decreases. The decrease in compensation voltage increases the capacity of the varactor, decreasing the output frequency of the ICOM.

SERVICE NOTE: Proper ICOM operation is dependent on the closely-controlled input voltages from the 10-Volt regulator. Should all of the ICOMs shift off frequency, check the 10-Volt regulator module.

AUDIO IC

The transmitter audio circuitry is contained in audio IC U101. A simplified drawing of the audio IC is shown in Figure 4.

Audio from the microphone at pin 12 is coupled through pre-emphasis capacitor C1 to the base of Q1 in the operational amplifier-limiter circuit. Collector voltage for the transistorized microphone preamplifier is supplied from pin 11 through microphone collector load resistor R18 to pin 12.

The operational amplifier-limiter circuit consists of Q1, Q2 and Q3. Q3 provides limiting at high signal levels. The gain of the operational amplifier circuit is fixed by negative feedback through R19, R20 and the resistance in the network (Pin 9).

The output of Q3 is coupled through a de-emphasis network (R10 and C3) to an active post-limiter filter consisting of C4, C5, C6, R11, R12, R13, R15, R17 and Q4.

Following the post-limiter filter is class A amplifier Q5. The output of Q5 is coupled through MOD ADJUST potentiometer R104 and resistor R125 to the phase modulator.

SERVICE NOTE: If the DC voltages to the Audio IC are correct and no audio output can be obtained, replace U101.

For radios equipped with Channel Guard, tone from the encoder is applied to the phase modulator through CHANNEL GUARD MOD ADJUST potentiometer R105, and resistor R127. Instructions for setting R105 are contained in the modulation adjustment section of the Transmitter Alignment Procedure.

BUFFER, PHASE MODULATORS & AMPLIFIERS

The output at pin 3 of the selected ICOM is coupled through buffer-amplifier Q101 to the modulator stage. The phase modulator is varactor (voltage-variable capacitor) CV103 in series with tunable coil T103. This network appears as a series-resonant circuit to the RF output of the oscillator. An audio signal applied to the modulator circuit through blocking capacitor C107 varies the bias of CV103, resulting in a phase modulated output. A voltage divider network (R110 and R111) provides the proper bias for varactor CV103.

The output of the modulator is coupled through blocking capacitor C150 to the base of Class A amplifier Q104. The output of the modulator is metered through C123, R128 and CR104, and is applied to the base of buffer Q105. Diodes CR105 and CR106 remove any amplitude modulation in the modulator output.

BUFFER, MULTIPLIERS & AMPLIFIER

Buffer Q105 is saturated when no RF signal is present. Applying an RF signal to Q105 provides a sawtooth waveform at its collector to drive the class C tripler, Q106. The tripler stage is metered through R138. The output of Q106 is coupled through tuned circuits T104 and T105 to the base of doubler Q107. The doubler stage is metered through R141.

The output of Q107 is coupled through tuned circuits T106 and T107 to the base of second doubler Q108. Q108 is metered through R146.

The output of Q108 is coupled through three tuned circuits (T108, T109 and T110) to the base of amplifier Q109.

Q109 is a Class C amplifier, and is metered through R148. The amplifier collector circuit consists of T111, C154, C155, T112 and C157, and matches the amplifier output to the input of the power amplifier assembly.

POWER AMPLIFIER

The PA assembly uses seven RF power transistors and seven transistors in the Power Control circuitry to provide rated power output. The broadband PA has no adjustments other than Power Control potentiometer R226.

Supply voltage for the PA is connected through power leads from the system board to feedthrough capacitors C297 and C298 on the bottom of the PA assembly. C297, C298, C299, L295 and L296 prevent RF from getting on the power leads. Diode CR295 will cause the main fuse in the fuse assembly to blow if the polarity of the power leads is reversed, providing reverse voltage protection for the radio.

Centralized metering jack J205 is provided for use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12. The Test Set meters the Tripler drive (exciter output), Ampl-2 input, Driver and PA current.

TRIPLER & RF AMPLIFIERS

The exciter output is coupled through an RF cable to PA input jack J201. The 50-ohm RF input is coupled through a matching network (C206 and W209) to the base of the broadband tripler stage, Q201.

Part of the RF input is rectified by CR201 and is used to activate the Power Control circuit. Another portion of the rectified RF is applied to J205 for metering the tripler drive.

output power, keeping the heatsink at a maximum of approximately 100°C. When the heatsink temperature decreases below 100°C, the temperature control circuit turns off, allowing the normal transmitter power output.

CARRIER CONTROL TIMER

The Carrier Control Timer option shuts off the transmitter on each transmission after a one-minute timing cycle, and alerts the operator that the transmitter is off by means of an alarm tone in the speaker. The transmitter can be turned on again by releasing and rekeying the push-to-talk switch on the microphone.

The timing cycle (transmitter keyed time) is normally set at the factory for a duration of one minute. A potentiometer permits the timing cycle to be adjusted from approximately 15 second to 3 minutes.

MAINTENANCE

DISASSEMBLY

To service the transmitter from the top:

1. Pull the locking handle down, then pry up the cover at the front notch and lift off the cover.

To service the transmitter from the bottom:

1. Pull the locking handle down and pull the radio out of the mounting frame.
2. Remove the top cover, then loosen the two bottom cover retaining screws and remove the bottom cover (see Figure 5).
3. To gain access to the bottom of the exciter board, remove the six screws Ⓐ holding the exciter board and its bottom cover to the module mounting frame, and remove the bottom cover.

To remove the exciter board from the radio:

1. Unplug the exciter/PA cable Ⓑ
2. Remove the six screws Ⓐ holding the exciter board and its bottom cover to the module mounting frame (see Figure 6).
3. Press straight down on the plug-in exciter from the top to avoid bending the pins when unplugging the board from the system board jack.

To remove the PA assembly:

1. Remove the Pa top cover and unplug the exciter/PA cable Ⓑ , the antenna, receiver and PTT cables Ⓒ .

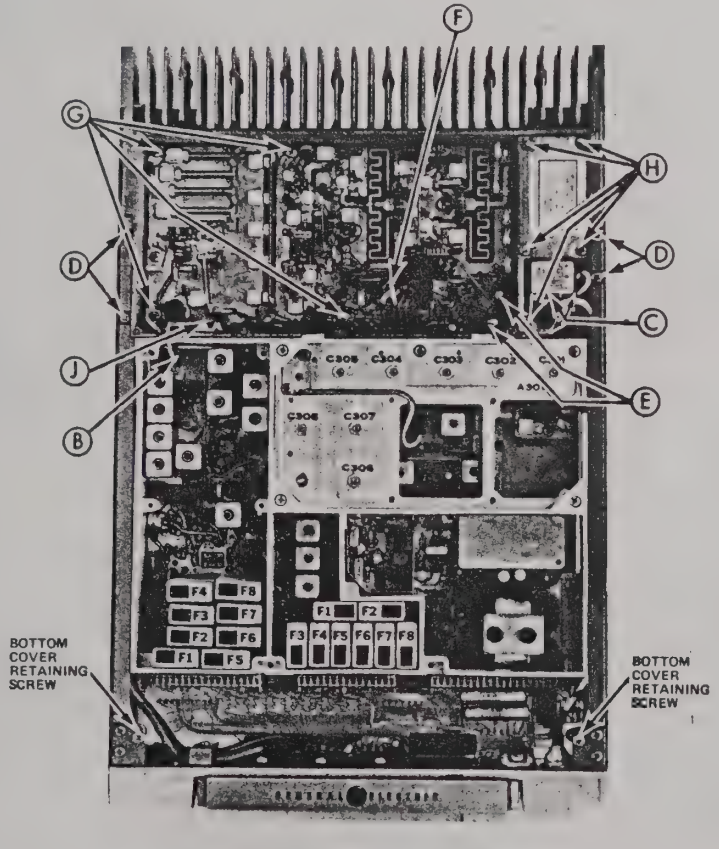


Figure 5 - Disassembly Procedure Top View

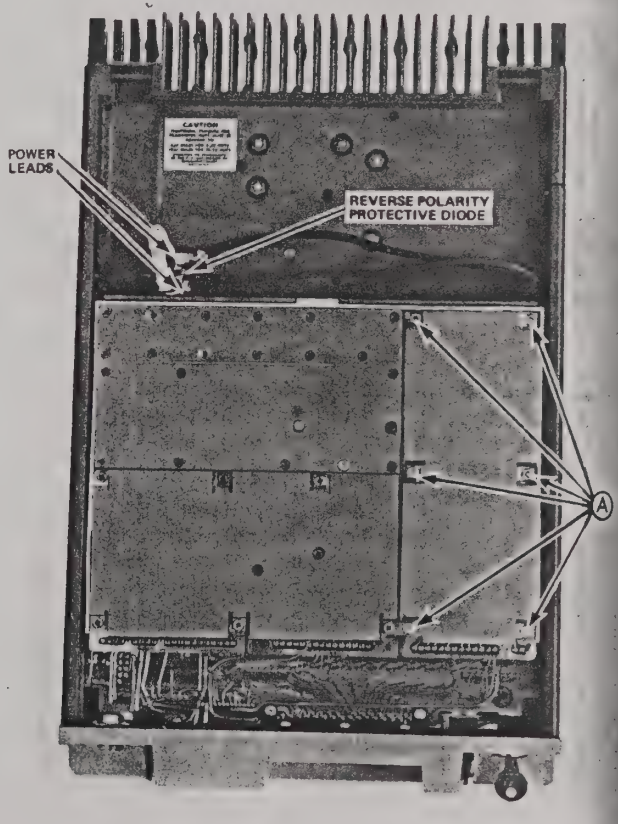


Figure 6 - Disassembly Procedure Bottom View

GE MOBILE RADIO

MAINTENANCE MANUAL
IF/AUDIO & SQUELCH BOARD
19D417707G1 & G2

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DESCRIPTION

The IF/Audio and Squelch board (IFAS) provides 120 dB IF gain, detects audio and provides squelch control. The IFAS board operates with an IF frequency of 11.2 or 9.4 MHz depending on the operating frequency of the radio. IFAS board 19D417707G1 operates with an IF frequency of 11.2 MHz and is used in radios operating in the following frequency bands:

- 25 - 30 MHz
- 36 - 42 MHz
- 138 - 174 MHz
- 406 - 420 MHz
- 450 - 512 MHz

IFAS board 19D417707G2 operates with an IF frequency of 9.4 MHz and is used in radios operating in the 30 - 36 MHz and 42 - 50 MHz frequency bands.

CIRCUIT ANALYSIS

Crystal Filters, IF Amp & Limiter

The IF input from the MIF or IF Filter board is applied to a four-pole monolithic crystal filter (FL601 and FL602). The crystal filter provides additional selectivity and is followed by impedance matching network Z601 and IF Amplifier IC U601. The IC amplifier provides approximately 60 dB of gain.

Final IF selectivity is provided by a two-pole crystal filter FL603. Impedance matching network Z602 matches the output impedance of IF amplifier IC U601 to the input of two-pole crystal filter FL603.

The IF amplifier output is metered at J601 through a metering network consisting of C611, C612, CR601 and CR602. Impedance matching network Z603 matches the output impedance of FL603 to the input of Limiter/Detector IC U602.

In addition to providing 60 dB of gain at the IF frequency, Limiter/Detector IC U602, C619, C620 and L603 comprise a quadrature phase detector to recover the audio from the IF frequency. The quadrature phase detector utilizes a 90 degree phase shift in the IF frequency to detect the audio signal. It compares the phase of the IF input at U602-4 with the same IF input frequency shifted 90 degrees at U602-2. The resultant signal varies phase linearly as the carrier signal deviates about the center frequency.

The detector output is adjusted for maximum audio output by L603 and is metered at J601 through R607.

AUDIO PREAMPLIFIER

The audio preamplifier consists of transistors Q601, Q602, and Q605. It provides approximately 26 dB of gain.

The output of the Limiter/Detector is coupled to the audio preamplifier through audio level adjust control R608. R608 sets the audio input level to the preamplifier circuit.

The output of the audio preamplifier is coupled through a low pass filter (L604 and C624) to volume and squelch control high. The filter removes any IF signal remaining in the audio output of the preamplifier.

RF from the antenna is link-coupled through helical resonator L2301 to the base of Class A pre-amplifier Q2301. L2301 matches the 50-ohm input to the base of Q2301. The amplified output is coupled through L2302, and connected through W2301 to J1 on Antenna Input Board A301. P2301 connects to J502 on the IF-Filter Board for regulated +10-Volt supply voltage.

ANTENNA INPUT A301

An RF signal from the antenna or UHS pre-amplifier is applied to A301 which provides an AC ground between vehicle ground and receiver A-. Resistor R1 prevents a static charge from building up on the vehicle antenna. The output of A301 is coupled through five high Q helical resonators that provide the front end RF selectivity. The helicals are tuned to the incoming frequency by C301 through C305.

MIXER A302

The mixer uses 4 hot-carrier diodes which are low noise diodes with non-linear resistance characteristics.

RF from the helical resonator is coupled to the mixer circuit through T1. Injection voltage from the oscillator-selectivity stages is coupled to the mixer circuit through T2. The mixer IF output is proportional to the level of the RF input and is independant of the injection voltage. The 11.2 MHz IF output is taken from H9 in the secondary of T1 and applied to an IF amplifier stage.

IF AMPLIFIER A303

The IF amplifier uses a Field-Effect Transistor (FET) as the active device. The mixer output is applied to the Gate of the amplifier, and the output is taken from the drain and applied to the IF Filter Board. The amplifier provides approximately 15 dB of IF gain.

OSCILLATOR - MULTIPLIER

The oscillator-multiplier can be equipped with up to eight Integrated Circuit Oscillator Modules (ICOMs). The ICOM crystal frequencies range from approximately 14.5 to 18.5 megahertz, and the crystal frequency is multiplied 27 times to provide a low side injection frequency to the mixer.

ICOMS

Three different types of ICOMs are available for use in the Osc/Mult module. Each of the ICOMs contains a crystal-controlled Colpitts oscillator, and two of the ICOMs contain compensator ICs. The different ICOMs are:

- 5C-ICOM - contains an oscillator and a 5 part-per-million (±0.0005%) compensator IC. Provides compensation for EC-ICOMs.
- EC-ICOM - contains an oscillator only. Requires external compensation from a 5C-ICOM.
- 2C-ICOM - contains an oscillator and a 2 PPM (±0.0002%) compensator IC. Will not provide compensation for an EC-ICOM.

The ICOMs are enclosed in a dust-proof, RF shielded can with the type ICOM (5C-ICOM, EC-ICOM or 2C-ICOM) printed on the top of the can. Access to the oscillator trimmer is obtained by prying up the plastic tab on the top of the can. The tabs can also be used to pull the ICOMs out of the radio.

Frequency selection is accomplished by switching the ICOM keying lead (terminal 6) to A- by means of the frequency selector switch on the control unit. In single-frequency radios, a jumper from H9 to H10 in the control unit connects terminal 6 of the ICOM to A-. In the receive mode, +10 Volts is applied to the external ICOM load resistor (R401) by the RX Osc control line, keeping the selected ICOM turned on. Keying the transmitter removes the 10 Volts at R401, turning the ICOM off.

CAUTION

All ICOMs are individually compensated at the factory and cannot be repaired in the field. Any attempt to repair or change an ICOM frequency will void the warranty.

In standard 5 PPM radios using EC-ICOMs, at least one 5C-ICOM must be used. The 5C-ICOM is normally used in the receiver F1 position, but can be used in any transmit or receive position. One 5C-ICOM can provide compensation for up to 15 EC-ICOMs in the transmitter and receiver. Should the 5C-ICOM compensator fail in the open mode, the EC-ICOMs will still maintain 2 PPM frequency stability from 0°C to 55°C (+32°F to 131°F) due to the regulated compensation voltage (+5 Volts) from the 10-Volt regulator IC. If desired, up to 16 5C-ICOMs may be used in the radio.

The 2C-ICOMs are self-compensated to 2 PPM and cannot provide compensation for EC-ICOMs.

AUDIO IC

The hybrid audio IC (U604) uses a custom flip-chip monolithic integrated circuit. The audio IC contains a standard EIA Channel Guard tone reject filter, a receiver de-emphasis circuit, and the low level audio PA drive circuitry.

Audio from the preamplifier is coupled through the VOLUME control to pin 4 of the audio IC from P904-13 (VOL ARM). Audio at pin 4 is applied to the Channel Guard tone reject circuit, and then to the 6 dB/octave de-emphasis circuit. The filter output is coupled through C635 to the differential audio driver circuit. The output of the audio driver circuit is DC-coupled to the push-pull, Class AB audio PA transistors, Q603 and Q604. The PA output is coupled through audio transformer T601 to provide low distortion, 12-watt output to the 8-ohm loudspeaker. R619 and C637 in the transformer secondary protects the PA transistors against a "no-load" or open circuit. Feedback from windings T601-3 and -4 determines the gain of the audio driver amplifier.

When the receiver is squelched, pin 1 of audio IC U604 is near A-, and the entire audio circuit is turned off to eliminate current drain. Pin 1 is also connected to the system board through P904-7 (RX MUTE) so that the receiver audio can be disabled by the time delay circuit in the 10-Volt regulator, and by the Channel Guard option when used.

Pins 6 and 7 are connected to the system board through P904-16 (RX PA) and P904-21 (INTCM INPUT) so that the receiver audio stages can be used to provide an audio output when the radio is equipped with the Intercom option.

Pin 2 is connected to the system board through P904-6 (SQ DISABLE) so that the receiver audio stages can be independently activated and used to provide an alert tone output when the radio is equipped with the Carrier Controlled Timer option.

SQUELCH IC

The hybrid squelch IC (U603) also uses a custom flip-chip monolithic integrated circuit. The squelch IC contains the noise amplifier, active noise filter, detector, slow and fast squelch circuits as well as the receiver unsquelched sensor (RUS) switch, and carrier activity sensor (CAS) switch.

Noise Amp, Filter & Active Detector

Noise from the limiter/detector is coupled through the SQUELCH control to pins 1 and 2 on the squelch IC. This signal is applied to the noise amplifier and then to the active filter circuit.

The noise amp and active filter provide the gain and selectivity to distinguish between noise and audio. The filter output drives the active detector circuit to provide the squelch switching functions. Thermistor RT601 keeps the input to the active detector constant over wide variations in temperature.

Slow & Fast Squelch

With a signal below the 20 dB quieting level, the slow squelch circuit provides a conventional slow (200 millisecond) squelch operation to prevent rapid squelch opening and closing in weak signal areas.

A signal at or above the 20 dB quieting level is sensed by the signal level detector and activates the fast squelch circuit, providing a fast (10 millisecond) squelch operation.

The squelch circuits have two outputs. One output controls the squelch switch and the other output controls the CAS switch.

Squelch Switch

The squelch switch output at pin 7 is connected to pin 1 of the audio IC. When the receiver is squelched, the output pin at 7 is near A-. This keeps the receiver audio stages turned off, muting the receiver. When the receiver is quieted by an on-frequency signal (unsquelches), the voltage at pin 7 rises to approximately +10 Volts. This turns on the audio stages and sound is heard at the speaker.

With the receiver unsquelched, the output of the squelch switch turns on the RUS switch. The output of the RUS switch is connected to the noise amplifier, providing a hysteresis loop in the squelch circuit. The RUS output increases the gain of the noise amplifier, preventing squelch closing on weak signals. The RUS output at pin 8 is also connected to the system board through P904-8 for special applications.

NOTE

In radios equipped with Channel Guard, the RUS switch will operate only when an "on-frequency" signal with the correct Channel Guard tone is applied to the receiver.

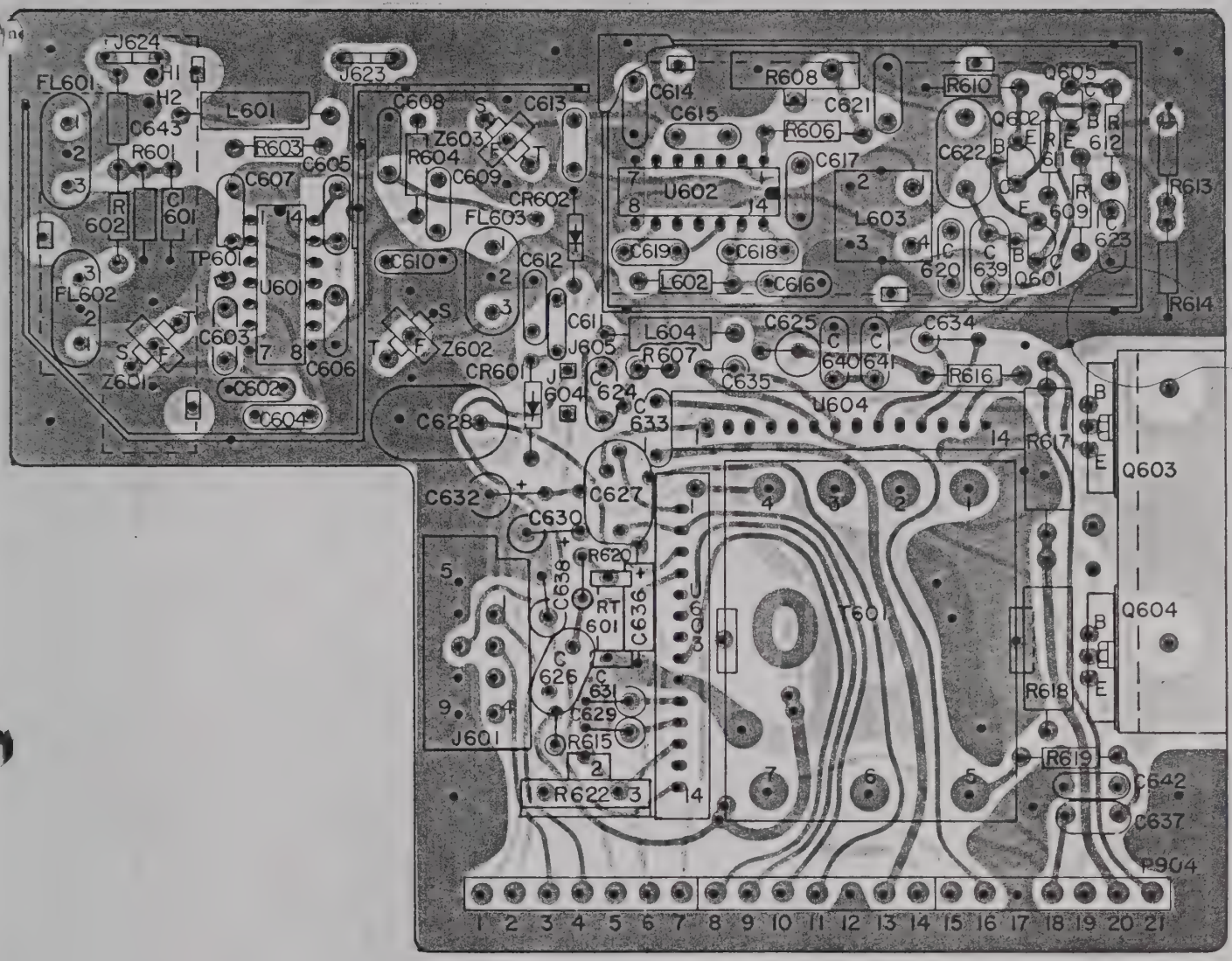
CAS Switch

The squelch circuits also drive the CAS switch. When the receiver unsquelches, the voltage at pin 6 rises to approximately 10 volts. This voltage is connected to the system board through P904-9, and is used to turn on an optional Channel Busy light on the control unit.

NOTE

The CAS switch will operate whenever an "on-frequency" signal is received, with or without a correct Channel Guard tone.

COMPONENT SIDE



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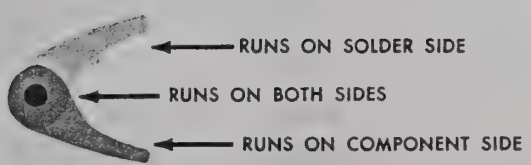
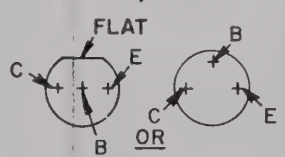
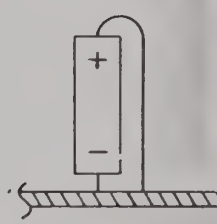


LEAD IDENTIFICATION
FOR Q601, Q602 & Q605



IN-LINE TRIANGULAR
VIEW FROM CASE END

NOTE: LEAD ARRANGEMENT AND NOT CASE SHAPE. IS DETERMINING FACTOR FOR LEAD IDENTIFICATION. TAB INDICATES EMITTER LEAD.



POLARITY FO
C634, C63
C630 & C63

OUTLINE DIAGRAM

IF/AUDIO/SQUELCH BOARD
19D417707G1 & G2

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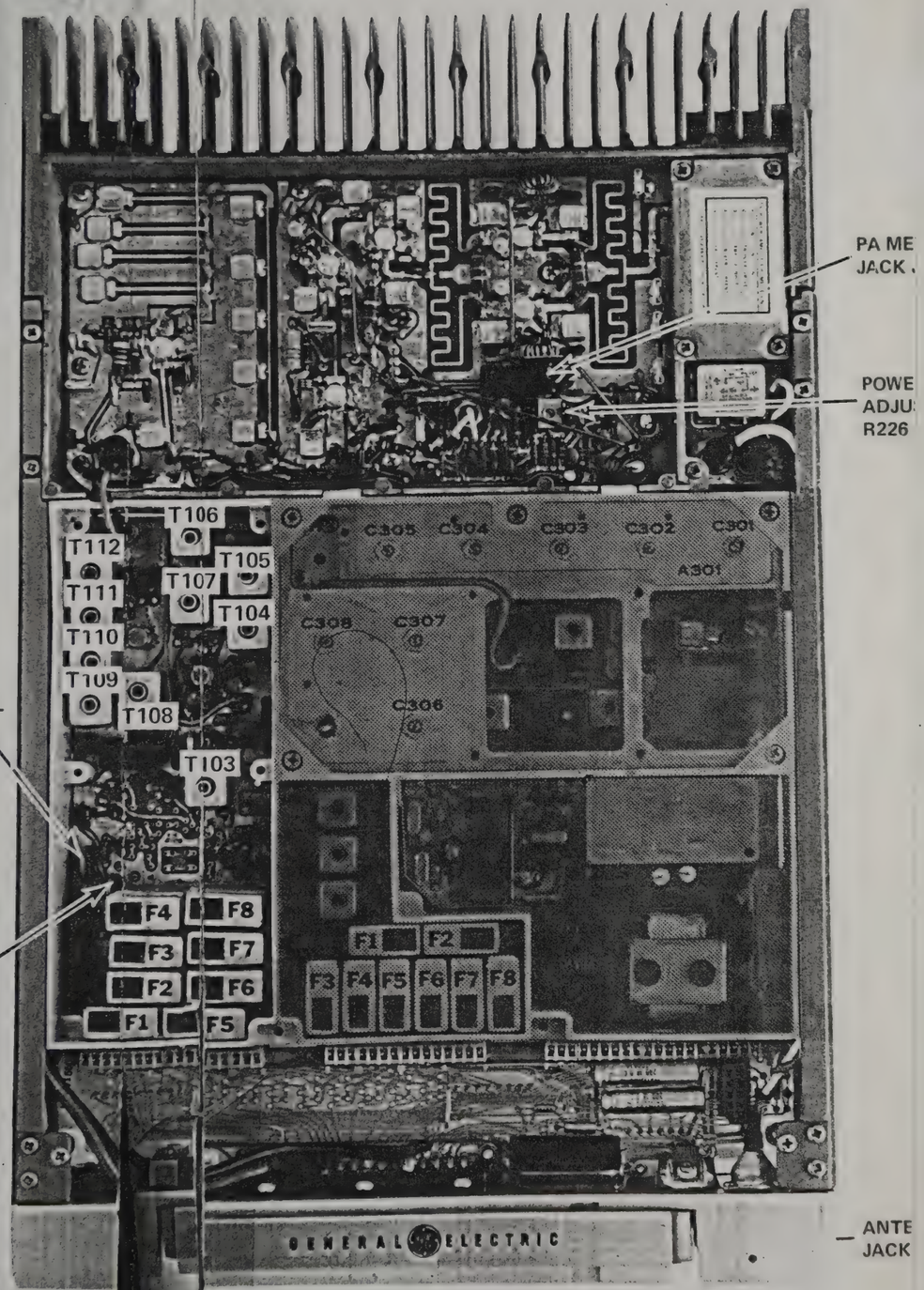


TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Model 4EX3A11 or Test Kit 4EX8K12.
2. A 50-ohm wattmeter connected to antenna jack J906.
3. A frequency counter.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place ICOMs on Exciter Board (crystal frequency = operating frequency ÷ 36).
2. For a large change in frequency or badly mis-aligned transmitter, pre-set the slugs in T104 and T105 to the bottom of the coil form. Pre-set all of the other slugs to the top of the coil form.

NOTE

The tuning frequency for multi-frequency transmitters is determined by the operating frequency and the frequency spread between transmitters. Refer to the table below for maximum frequency spread.

3. For multi-frequency transmitters with a frequency spread less than that specified in column (1) tune the transmitters to the lowest frequency. For a frequency spread exceeding the limits specified in column (1) tune the transmitters using a center frequency tune up ICOM. Except the maximum frequency spread can be extended to the limits specified in column (3) with 1 dB degradation.

   For tuning L101, L102, and L103, always tune L101, L102, and L103 on the lowest frequency.

Multi-frequency Transmitter Tuning

Transmitter Frequency Range	MAXIMUM FREQUENCY SPREAD		
	(1) Without center tuning	With center tuning	With center tuning (1 dB degradation)
406-420 MHz	2.75 MHz	5.50 MHz	6.00 MHz
450-470 MHz	2.75 MHz	5.50 MHz	9.00 MHz
470-494 MHz	2.90 MHz	5.80 MHz	9.50 MHz
494-512 MHz	3.00 MHz	6.00 MHz	9.75 MHz

4. Connect the red plug on the GE Test Set to the System Board metering jack, and the black plug to the Exciter metering jack. Set the polarity to +, and set the range to the Test 1 position (1-Volt position for 4EX8K12) for all adjustments.
   NOTE: With the Test Set connected to the PA metering jack, the voltage reading at position "F" with the HIGH SENSITIVITY button pres may be converted to driver collector current by reading the current as 10 amperes full scale. The voltage reading at position "G" wi the HIGH SENSITIVITY button pressed may be converted to PA collector current by reading the current as 10 amperes full scale.
5. All adjustments are made with the transmitter keyed. Unkey the transmitter between steps to avoid unnecessary heating.

STEP	METER POSITION	TUNING CONTROL	METER READING	PROCEDURE
1.	B (MOD-1)	T103	See Procedure	Tune T103 for the maximum meter reading on the lowest frequency. After tuning T103 for maximum, turn the slug 1/8 of a turn clockwise(increasing inductance
2.	C (MULT-1)	T104	Minimum	Tune T104 for a dip in meter reading.
3.	D (MULT-2)	T105, T104 & T106	See Procedure	Tune T105 for maximum meter reading and re-adjust T104 for maximum meter reading. Then tune T106 for a dip in meter reading.
4.	F (MULT-3)	T107, T106, T108 & T109	See Procedure	Tune T107 for maximum meter reading and re-adjust T106 for maximum meter reading. Then tune T108 for a dip in meter reading and T109 for maximum meter readin
5.	G (AMPL-1)	T110, T108 & T109	Maximum	Tune T110 for maximum meter reading, and then re-adjus T108 and T109 for maximum meter reading.
6.	D (AMPL-1 DRIVE on PA)	T111 & T112	Maximum	Move the black metering plug to the Power Amplifier metering jack and tune T111 and then T112 for maximum meter reading. Then alternately tune T111 and T112 for maximum meter reading.
7.	G (AMPL-1)	T108, T109 & T110	Maximum	Move the black metering plug back to the exciter meter ing jack and re-adjust T108, T109 and T110 for maximum meter reading.
8.	D (AMPL-1 DRIVE on PA)	T111 & T112	Maximum	Move the black metering plug back to the Power Amplifi metering jack and re-adjust T111 and T112 for maximum meter reading.
9.		R226		With the battery voltage at 13.6 Volts or the PA collector voltage at 13.0 Volts, set Power Adjust potentiometer R226 on the PA board for the desired power output (from 12 to 40 Watts). If the battery voltage is not at 13.6 Volts or the collector voltage at 13.0 Volts and full rated output is desired (40,38 or 35 Watts at 13.6 Volts), set R226 for the output power according to the battery voltage collector voltage shown in Figures 10, 11 or 12. NOTE The PA collector voltage is measured as described in the PA POWER INPUT section.
	ADDITIONAL STEPS FOR TRANSMITTERS USING CENTER FREQUENCY TUNE-UP ICOM			
10.	D (MULT-2)	T105	See Procedure	Move the black metering plug to the exciter metering jack and re-adjust T105 for equal drive on the highest and lowest frequency.
11.	G (AMPL-1)	T110 & T108	Maximum	Re-adjust T110 and then T108 for maximum meter read ing on the lowest frequency.

FRONT END ALIGNMENT

EQUIPMENT

1. GE Test Set Models 4EX3A11, 4EX8K12, or 20,000 ohms-per-Volt Multimeter with a 1-Volt scale.
2. A 406-512 MHz signal source.

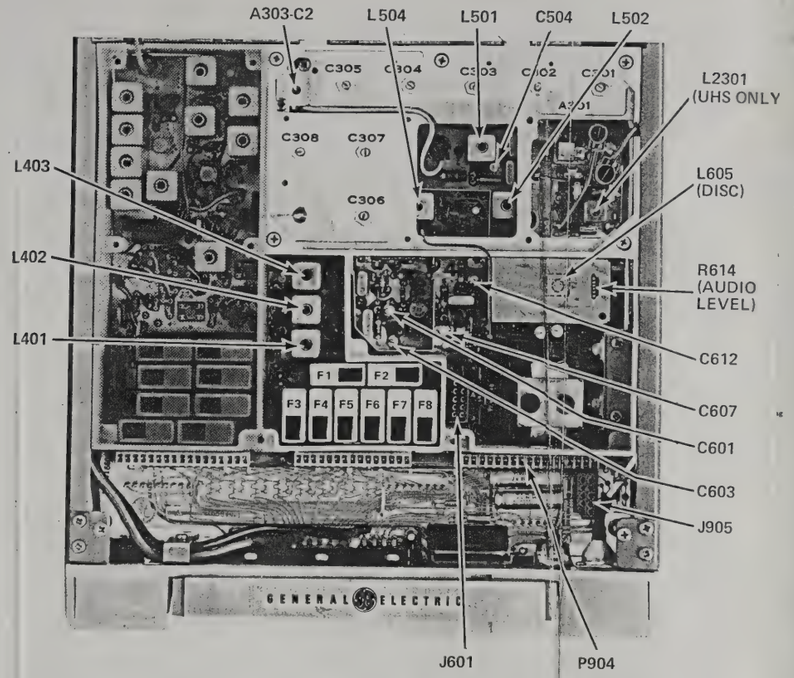
PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect black plug from Test Set to Receiver Centralized Metering Jack J601, and red plug to system board metering jack J905. Set meter sensitivity switch to the TEST 1 position (or 1-Volt position on 4EX8K12).
2. For multi-frequency receivers with a frequency spacing up to 0.800 MHz for frequency range of 406-470 MHz, 0.900 MHz for frequency range of 470-494 MHz or 0.750 MHz for frequency range of 494-512 MHz, align the receiver on the channel nearest center frequency.

   For multi-frequency receivers with a frequency spacing exceeding the above but no greater than 1.60 MHz for frequency range of 406-470 MHz, 1.80 MHz for frequency range of 470-494 MHz, or 1.50 MHz for frequency range of 494-512 MHz, align the receiver using a center frequency tune-up ICOM. These limits can be extended to 2.00 MHz, 2.30 MHz and 2.00 MHz respectively, with 3 dB degradation in standard receiver specifications.
3. With Test Set in Position J, check for regulated +10 Volts. If using Multimeter, measure between J905-3 (+) and J905-9 (-).
4. If using Multimeter, connect the negative lead to J601-9 (A-).
5. Disable Channel Guard.

ALIGNMENT PROCEDURE

STEP	METERING POSITION: GE Test Set	METERING POSITION: Multimeter - at J601-9	TUNING CONTROL	METER READING	PROCEDURE
		OSCILLATOR/MULTIPLIER			
1.	C (MULTI-1)	Pin 3	L401	Maximum	Tune L401 for maximum meter reading.
2.	D (MULTI-2)	Pin 4	L402, L403, C306	See Procedure	Tune L402 and L403 for maximum meter reading. Then carefully tune C306 for a change in meter reading.
3.	F (MULTI-3)	Pin 7	C307, C306, C308	See Procedure	Tune C307 for maximum meter reading then C308 for a dip. Next, tune C306 and C307 for maximum meter reading. Then tune C308 for a dip in meter reading.
		RF SELECTIVITY			
4.	A (DISC)	Pin 2		Zero	Apply an on-frequency signal to the antenna jack. Adjust the signal generator for discriminator zero.
5.	B (IF AMP)	Pin 1	A303-C2, C301 thru C305 (and L2301 if present)	Maximum	Apply an on-frequency signal to the antenna jack, keeping the signal below saturation. Then tune A303-C2 and C301 through C305 for maximum meter reading. In receivers with the UHS pre-amplifier, also tune L-2301 for maximum meter reading.
6.	B (IF AMP)	Pin 1	A303-C2, C301 thru C305 (and L2301 if present)	Maximum	Apply an on-frequency signal to the antenna jack and slightly tune A303-C2, C301 through C305 (and L2301 if present) for best quieting sensitivity.



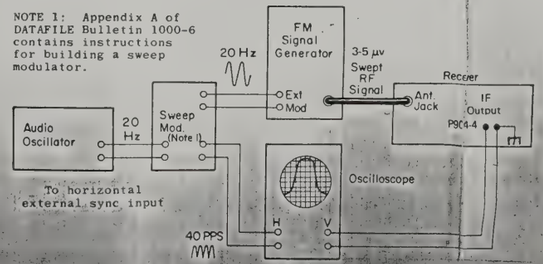


Figure 6 - Test Setup for 20-Hz Double-Trace Sweep Alignment

COMPLETE RECEIVER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Models 4EX3A11, 4EX8K12 (or 20,000 ohms-per-Volt Multimeter with a 1-Volt scale.)
2. An 11.2 MHz signal source (GE Test Set Model 4EX9A10). Also a 406-512 MHz signal source (Measurements 803) with a one-inch piece of insulated wire no larger than .065 inch diameter connected to generator probe.
3. A VTVM.

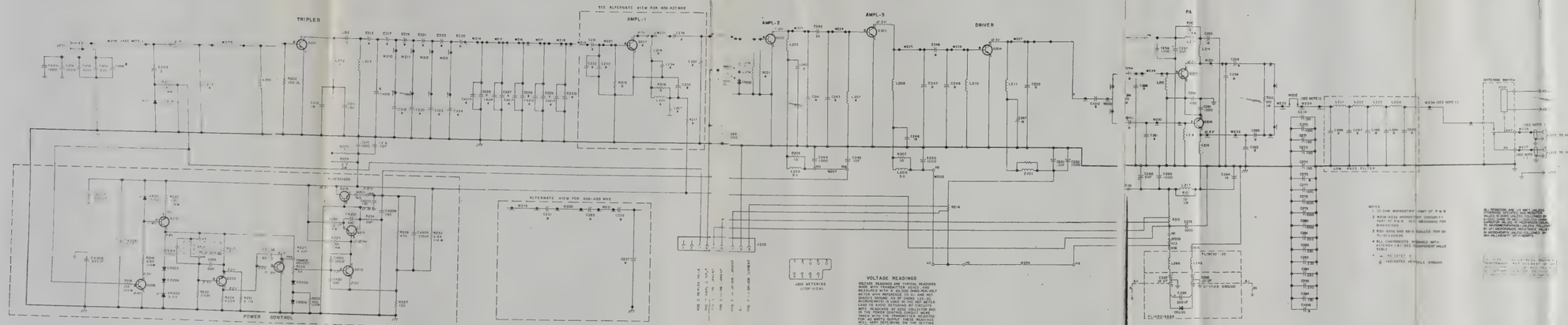
PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect the black plug from the Test Set to receiver metering jack J601, and the red plug to system board metering jack J905. Set the meter sensitivity switch to the Test 1 (or 1-Volt position on the 4EX8K12).
2. For multi-frequency receivers with a frequency spacing up to 0.800 MHz for frequency range of 406-470 MHz, 0.900 MHz for frequency range of 470-494 MHz or 0.750 MHz for frequency range of 494-512 MHz, align the receiver on the channel nearest center frequency.

   For multi-frequency receivers with a frequency spacing exceeding the above but no greater than 1.60 MHz for frequency range of 406-470 MHz, 1.80 MHz for frequency range of 470-494 MHz, or 1.50 MHz for frequency range of 494-512 MHz, align the receiver using a center frequency tune-up ICOM. These limits can be extended to 2.00 MHz, 2.30 MHz and 2.00 MHz respectively, with 3 dB degradation in standard receiver specifications.
3. With the Test Set in Position J, check for regulated +10 Volts. With multimeter, measure from J905-3 to J905-9.
4. If using Multimeter, connect the negative lead to J601-9 (A-).
5. Disable the Channel Guard.

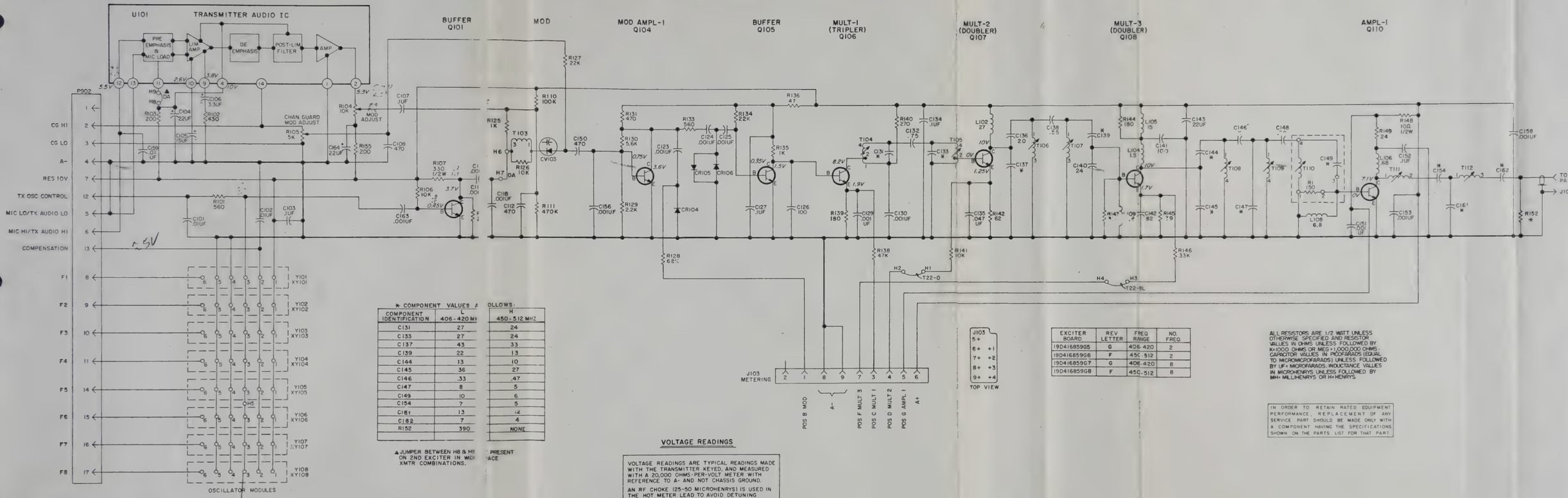
ALIGNMENT PROCEDURE

STEP	METERING POSITION: GE Test Set	METERING POSITION: Multimeter - at J601-9	TUNING CONTROL	METER READING	PROCEDURE
		DISCRIMINATOR			
1.	A (DISC)	Pin 2	L605	Zero	Apply the correct IF signal between J624 and A-, and tune L605 for zero meter reading.
2.	A (DISC)	Pin 2	R614	1 Volt RMS	Remove the Test set metering plug from J601. Apply a 100 microvolt signal with 1 kHz modulation and 3 kHz deviation to the antenna jack. Set R614 for 1 Volt RMS measured with a VTVM at P904-11 (VOL/SQ HI) and P904-17 (A-).
3.	C (MULT-1)	Pin 3	L401	Maximum	Re-connect the Test set metering plug to J601. Tune L401 for meter reading.
4.	D (MULT-2)	Pin 4	L402, L403 and C306	See Procedure	Tune L402 and L403 for maximum meter reading. Then carefully tune C306 for a change in meter reading.
5.	F (MULT-3)	Pin 7	C306, C307 and C308	See Procedure	Tune C307 for maximum meter reading, then C308 for a dip. Next, tune C306 and C307 for maximum meter reading, then tune C308 for a dip in meter reading.
		RF SELECTIVITY			
6.	A (DISC)	Pin 2		Zero	Apply an on-frequency signal in the hole adjacent to C304. Adjust the signal generator for discriminator zero.
7.	B (IF AMP)	Pin 1	C305 and C304	Maximum	Apply an on-frequency signal in the hole adjacent to C304, keeping the signal below saturation. Then tune C305 and then C304 for maximum meter reading.
8.	B (IF AMP)	Pin 1	C304 and C303	Maximum	Apply an on-frequency signal in the hole adjacent to C303, keeping the signal below saturation. Then tune C304 and then C303 for maximum meter reading.
9.	B (IF AMP)	Pin 1	C303 and C302	Maximum	Apply an on-frequency signal in the hole adjacent to C302, keeping the signal below saturation. Then tune C303 and then C302 for maximum meter reading.
10.	B (IF AMP)	Pin 1	C302 and C301	Maximum	Apply an on-frequency signal to the antenna jack, keeping the signal below saturation. Then tune C302 and C301 for maximum meter reading.
11.	B (IF AMP)	Pin 1	A303-C2, C301 thru C305 (and L2301 if present)	Maximum	Apply an on-frequency signal to the antenna jack, keeping the signal below saturation. Then tune A303-C2 and C301 through C305 for maximum meter reading. In receivers with the UHS preamplifier, also tune L2301 for maximum meter reading.
12.	B (IF AMP)	Pin 1	A303-C2, C301 thru C305 (and L2301 if present)	Maximum	Apply an on-frequency signal to the antenna jack and slightly tune A303-C2, C301 through C305 (and L2301 if present) for best quieting sensitivity.
		MIXER & IF			
The mixer and IF circuits have been aligned at the factory and will normally require no further adjustment. If adjustment is necessary, use the procedure outlined in STEP 13.					
		NOTE: Refer to DATAFILE BULLETIN 1000-6 (IF Alignment of Two-Way Radio FM Receivers) for helpful suggestions on how to determine when IF Alignment if required.			
13.		L501, L503, L504, C504, C601, C603, C607 and C612			Connect scope, signal generator, and probe as shown in Figure 6. Set signal generator level for 3 to 5 μV and modulate with 10 kHz at 20 Hz. With probe between P904-4 (or J601-1) and A-, tune L501, L503, L504, C504, C601, C603, C607 and C612 for double trace as shown on scope pattern.
14.	A	Pin 2		See Procedure	Check to see that discriminator idling voltage is within ±.05 Volt of zero with no signal applied. Check to see that modulation acceptance bandwidth is greater than ±7 kHz.



SCHEMATIC DIAGRAM

406—512 MHz, 40-WATT POWER AMPLIFIER
19C320620G5-G8



* COMPONENT VALUES A OLLOWS:

COMPONENT IDENTIFICATION	L 406-420 MHz	H 450-512 MHz
C131	27	24
C133	27	24
C137	43	33
C139	22	13
C144	13	10
C145	36	27
C146	33	47
C147	8	5
C149	10	6
C154	7	5
C161	13	12
C162	7	4
R152	390	NONE

▲JUMPER BETWEEN H8 & H9 PRESENT ON 2ND EXCITER IN WIDE XMTR COMBINATIONS.

EXCITER BOARD	REV. LETTER	FREQ. RANGE	NO. FREQ.
19D416859G5	G	406-420	2
19D416859G6	F	450-512	2
19D416859G7	G	406-420	8
19D416859G8	F	450-512	8

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED. AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS; CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS; INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

VOLTAGE READINGS

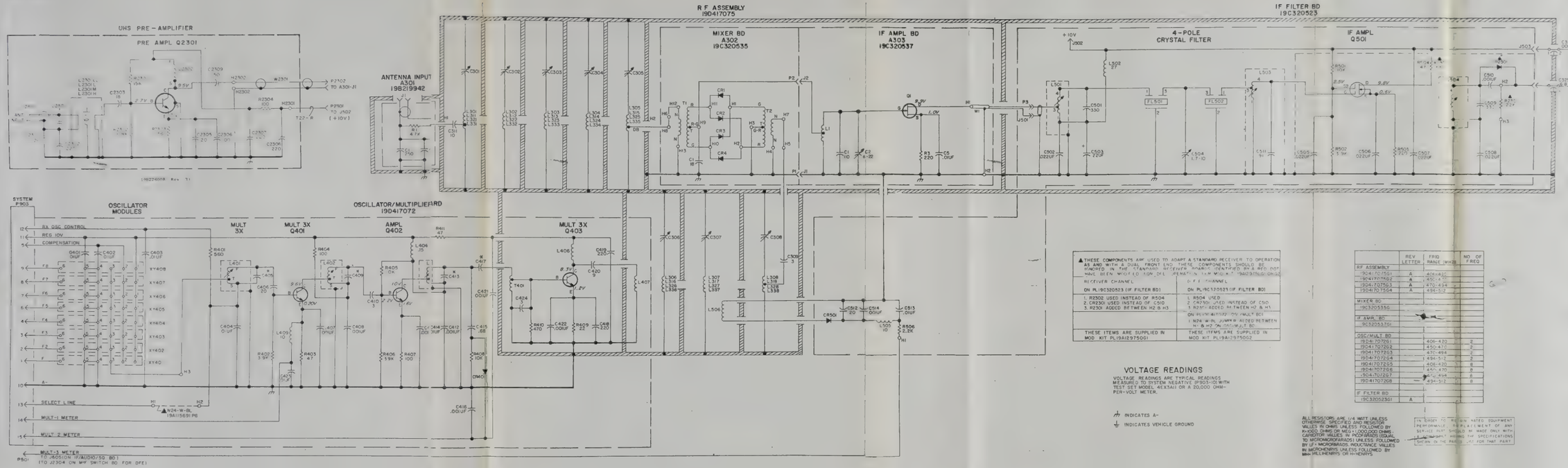
VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED, AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER WITH REFERENCE TO A- AND NOT CHASSIS GROUND.

AN RF CHOKE (25-50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUITS.

(19B622018, Rev. 11)

SCHEMATIC DIAGRAM

406—512 MHz, EXCITER BOARD
19D416859G5-G8



SCHEMATIC DIAGRAM

406—512 MHz RECEIVER RF ASSEMBLY, IF-FILTER BOARD ASSEMBLY, OSC/MULT AND UHS PRE-AMPLIFIER

▲THESE COMPONENTS ARE USED TO ADAPT A STANDARD RECEIVER TO OPERATION AS AND WITH A DUAL FRONT END. THESE COMPONENTS SHOULD BE INSERTED IN THE STANDARD RECEIVER PARTS IDENTIFIED BY A RED DOT WHO HAS BEEN MODIFIED FOR DFE. (PENCIL TUNED KIT 19A237650G1 ONLY)

RECEIVER CHANNEL	DUAL FRONT END CHANNEL
ON PL19C320523 (IF FILTER BD)	ON PL19C320523 (IF FILTER BD)
1. R2302 USED INSTEAD OF R504 2. CR2301 USED INSTEAD OF C502 3. R2301 ADDED BETWEEN H2 & H3	1. R504 USED 2. CR2301 USED INSTEAD OF C502 3. R2301 ADDED BETWEEN H2 & H3 ON PL19C320523 (IF FILTER BD) 4. N24-W-BL JUMPER ADDED BETWEEN H1 & H2 ON PL19C320535 (MIXER BD)
THESE ITEMS ARE SUPPLIED IN MOD KIT PL19A129750G1	THESE ITEMS ARE SUPPLIED IN MOD KIT PL19A129750G2

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (P903-D) WITH TEST SET MODEL 4EX3A11 OR A 20,000 OHM-PER-VOLT METER.

⏚ INDICATES A-

⏚ INDICATES VEHICLE GROUND

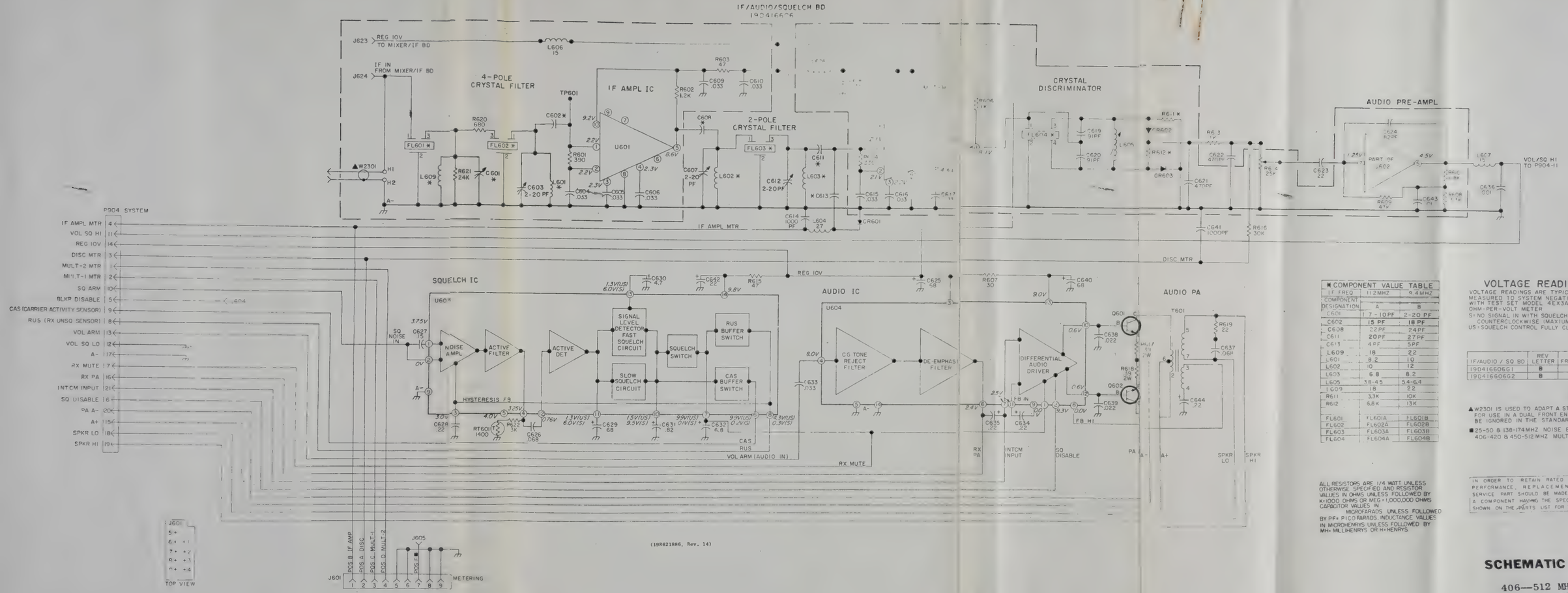
	REV. LETTER	FREQ RANGE (MHZ)	NO. OF FREQ
RF ASSEMBLY			
19D417075G1	A	406-420	2
19D417075G2	A	450-470	2
19D417075G3	A	470-494	2
19D417075G4	A	494-512	2
MIXER BD			
19C320535G			
IF AMPL BD			
19C320537G1			
OSC/MULT BD			
19D417072G1		406-420	2
19D417072G2		450-470	2
19D417072G3		470-494	2
19D417072G4		494-512	2
19D417072G5		406-420	8
19D417072G6		450-470	8
19D417072G7		470-494	8
19D417072G8		494-512	8
IF FILTER BD			
19C320523G1	A		2

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY (F = MICROFARADS). INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

IN ORDER TO MAINTAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A PART HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

* COMPONENT VALUE TABLE

COMP DESIG	L	L	M	H
RF FREQ MHZ	406-4	450-470	470-494	494-512
301	X			
302	X			
L303	X			
L304	X			
L305	X			
L306	X			
L328	X			
L311		X		
L312		X		
L313		X		
L314		X		
L315		X		
L316		X		
L317		X		
L318		X		
L321			Y	
L322			Y	
L323			Y	
L324			Y	
L326			Y	
L326			X	
L327			X	
L328			Y	
L331				X
L332				X
333				X
334				X
L335				X
L336				X
L337				X
L338				X
C405	18	15	12	10
C409	8	6	4	3
C413	8	6	4	3
C417	7	5	5	5



✱COMPONENT VALUE TABLE		
IF FREQ	11.2MHZ	9.4MHZ
COMPONENT DESIGNATION	A	B
C601	7 - 10PF	2 - 20 PF
C602	15 PF	18 PF
C608	22 PF	24 PF
C611	20PF	27PF
C615	4 PF	5PF
L609	18	22
L601	8.2	10
L602	10	12
L603	6.8	8.2
L605	38-45	54-64
L609	18	22
R611	3.3K	10K
R612	6.8K	13K
FL601	FL601A	FL601B
FL602	FL602A	FL602B
FL603	FL603A	FL603B
FL604	FL604A	FL604B

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS CAPACITOR VALUES IN MICROFARADS UNLESS FOLLOWED BY PF= PICOFARADS, INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (P904-17) WITH TEST SET MODEL 4EX3A11 OR A 20,000 OHM-PER-VOLT METER

S=NO SIGNAL IN WITH SQUELCH CONTROL FULLY COUNTERCLOCKWISE (MAXIUM SQUELCH)

US=SQUELCH CONTROL FULLY CLOCKWISE

IF/AUDIO / SQ BD	REV LETTER	IF FREQ(MHZ)
19D416606G1	B	11.2
19D416606G2	B	9.4

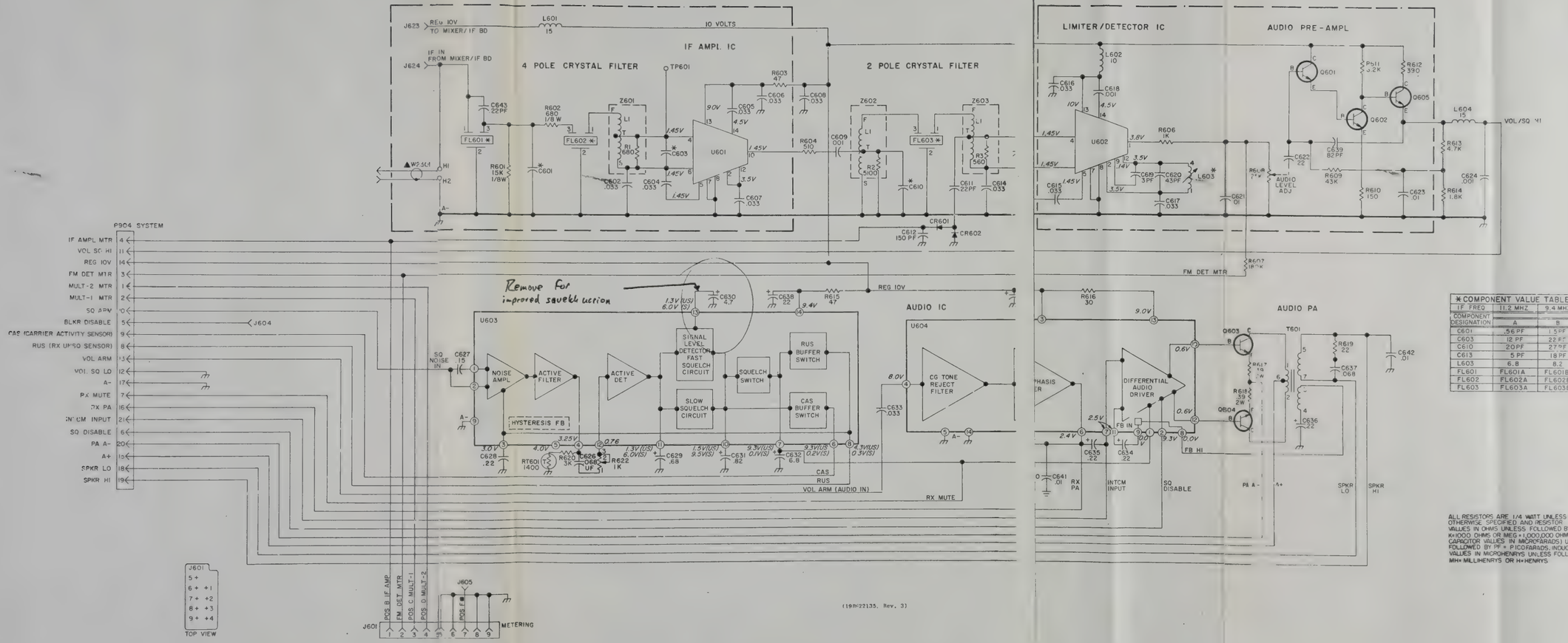
▲W2301 IS USED TO ADAPT A STANDARD BD FOR USE IN A DUAL FRONT END IT SHOULD BE IGNORED IN THE STANDARD BD.

■25-50 & 138-174MHZ NOISE BLANKER TEST POINT 406-420 & 450-512MHZ MULT-3 TEST POINT

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART

SCHEMATIC DIAGRAM

406—512 MHz, IF AUDIO AND SQUELCH BOARD



*COMPONENT VALUE TABLE		
IF FREQ	11.2 MHZ	9.4 MHZ
COMPONENT DESIGNATION	A	B
C601	.56 PF	1.5 PF
C603	12 PF	22 PF
C610	20 PF	27 PF
C613	5 PF	18 PF
L603	6.8	8.2
FL601	FL601A	FL601B
FL602	FL602A	FL602B
FL603	FL603A	FL603B

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (P904-17) WITH TEST SET MODEL 4EX3AII OR A 20,000 OHM-PER-VOLT METER.

S+NO SIGNAL IN WITH SQUELCH CONTROL FULLY COUNTERCLOCKWISE (MAXIUM SQUELCH)

US+SQUELCH CONTROL FULLY CLOCKWISE

IF/AUDIO/SQ BD	REV. LETTER	IF FREQ (MHZ)
19D417707G1	B	11.2
19D417707G2	B	9.4

▲W2301 IS USED TO ADAPT A STANDARD BD FOR USE IN A DUAL FRONT END IT SHOULD BE IGNORED IN THE STANDARD BD.

■25-50 & 138-174 MHZ NOISE BLANKER TEST POINT 406-420 & 450-512 MHZ MULT-3 TEST POINT

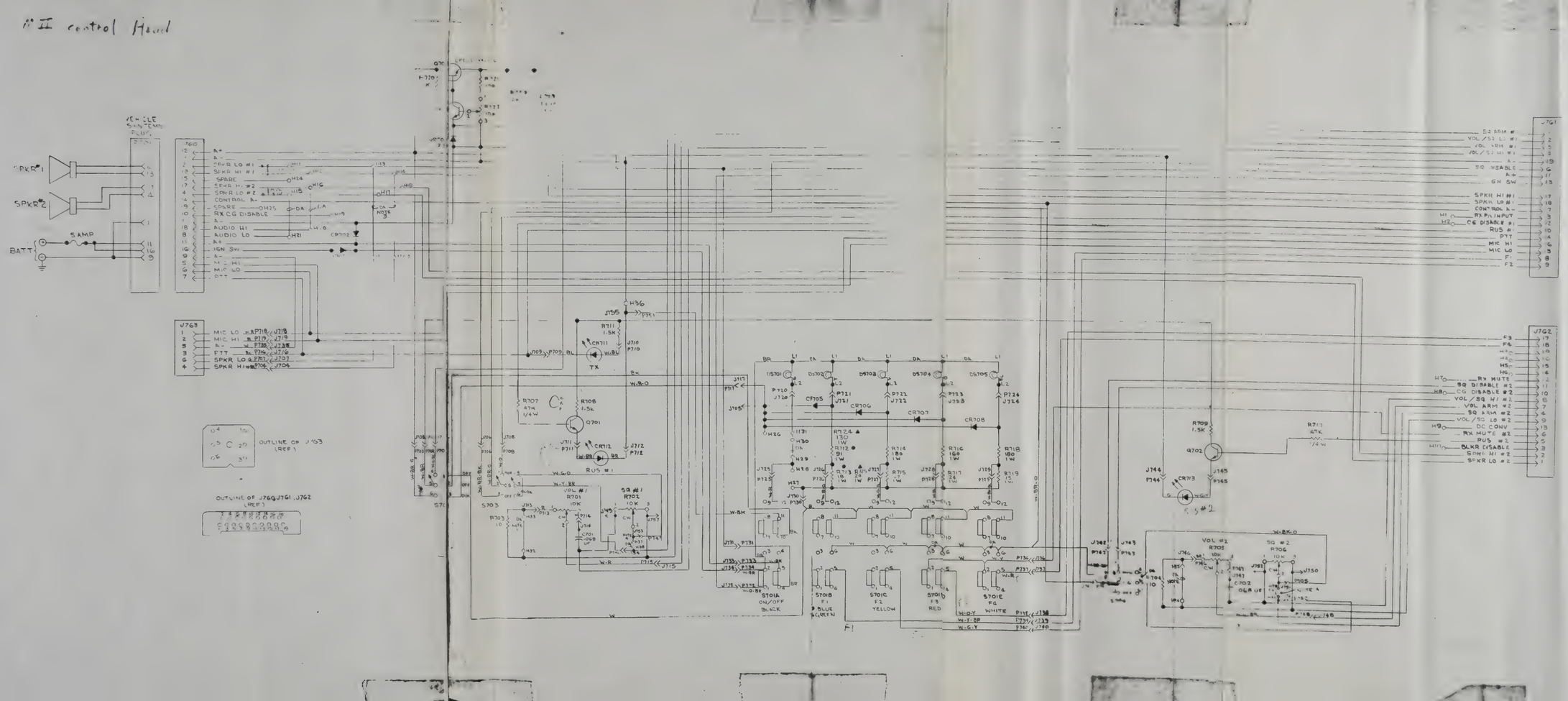
ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY: K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN MICROFARADS UNLESS FOLLOWED BY PF = PICOFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

SCHEMATIC DIAGRAM

IF/AUDIO/SQUELCH BOARD
19D417707G1 & G2

"II control Head



GENERAL ELECTRIC

19C321709

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING —
SURFACES ✓ | TOLERANCES ON MACHINED DIMENSIONS: FRACTIONS ± | DECIMALS ± | ANGLES ±

TITLE DIAGRAM, WIRING
CONTROL CABLE

FIRST MADE FOR REQ F301-2645 (FEDERAL ELECTRIC)

TX A+ — #8 — R
TX A- — #8 — BK

P702

1	SQ ARM #1	GY
2	VOL/SQ LO #1	SHIELD
5	VOL ARM #1	BL
4	VOL/SQ HI #1	G
19	A-	16-BK
6	SQ DISABLE #1	O
11	A+	16-Y
13	IGN SW	R
17	SPKR HI #1	16-G
18	SPKR LO #1	16-BR
7	CONTROL A-	SHIELD
3	RX PA	Y-G
12	C G DISABLE #1	W-G
10	RUS #1	V
14	PTT	W
6	MIC HI	22-BR
15	MIC LO	SHIELD
8	F1	W-BR
9	F2	W-R

P703

17	F3	W-BL
18	F4	W-V
19	F5	W-GY
16	F6	W-O
15	F7	W-Y
14	F8	Y-BK
12	RX MUTE #1	Y-BL
11	SQ DISABLE #2	Y-R
10	CG DISABLE #2	Y-GY
8	VOL/SQ HI #2	BR
7	VOL ARM #2	RED
4	SQ ARM #2	O
9	VOL/SQ LO #2	SHIELD
13	DC CONV CONT	Y-BR
6	RX MUTE #2	BL
5	RUS #2	Y-G
3	BLKR DISABLE	Y-V
2	SPKR HI #2	O-G
1	SPKR LO #2	O-BL

TX A+		39
TX A-		40
BR	DC CONV CONT	1
BL	RX MUTE #1	3
ELD	CONTROL A-	21
GY	CG DISABLE #2	5
IELD	MIC LO	2
-BR	MIC HI	4
R	SQ DISABLE #2	7
BR	F1	8
R	F2	9
BL	F3	10
V	F4	11
GY	F5	12
O	F6	13
Y	F7	14
BK	F8	15
V	BLKR DISABLE	26
	IGN SW	24
	PTT	25
	SQ DISABLE #1	23
	RUS #1	16
	SQ ARM #1	17
	VOL/SQ HI #1	20
IELD	VOL/SQ LO #1	18
	VOL ARM #1	19
Y	A+	29
G	RX PA	22
BK	A-	30
BR	SPKR LO #1	27
G	SPKR HI #1	28
G	C G DISABLE #1	6
	VOL/SQ HI #2	31
	VOL ARM #2	32
	SQ ARM #2	35
ELD	VOL/SQ LO #2	36
	RX MUTE #2	33
	RUS #2	34
G	SPKR HI #2	37
BL	SPKR LO #2	38

P901

CONT ON SHEET — DRAWING NO. — REV NO.

MADE FROM 19C320398 REV. 3

REVISIONS	PRINTS TO
	L59

MADE BY — JULY 18, 1974 — APPROVALS — MRPD — DIV OR DEPT — 19C321709
ISSUED — JULY 19 1974 — LYNCHBURG, VA. — LOCATION — CONT ON SHEET — SH NO.

EC-22

Wiring Diagram
For 19D423424
Cable

APPLIED PRACTICES 19A1218850 | SURFACES ✓ | UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING — TOLERANCES ON MACHINED DIMENSIONS: FRACTIONS ± | DECIMALS ± | ANGLES ±

TITLE DIAGRAM, W
30 & 38 CONDUCTOR CONT. CABLE
FIRST MADE FOR MOBILE RADIO (955)
F.C.F.O. PL19D423424

TO FUSE ASM
AND BATTERY HOT

#8-R

P702

1	SQ ARM	GA
2	VOL/SQ LO	SHIELD
5	VOL ARM	BL
4	VOL/SQ HI	G
19	A-	16-BK
6	SQ DISABLE	O
11	A+	16-Y
13	IGN SW	R
17	SPKR HI	16-G
18	SPKR LO	16-BR
7	CONTROL A-	SHIELD
3	RX PA	Y-G
12	CG DISABLE	W-G
10	CAS	V
14	PTT	W
16	MIC HI	22-BR
15	MIC LO	SHIELD
8	FI	W-BR
9	F2	W-R

P703

17	F3	W-BL
18	F4	W-V
19	F5	W-GA
16	F6	W-O
15	F7	W-Y
14	F8	Y-BK
12	RX MUTE	Y-BL
11	SPARE	Y-R
10	SPARE	Y-GA
* 8	F9	Y
13	DC CONV CONT	Y-BR
* 7	F10	G
* 6	SPARE	W
* 5	SPARE	SHIELD
3	BLKR DISABLE	Y-V
* 4	F11	O-BR
* 9	F12	O-R
* 2	SPARE	O-G
* 1	SPARE	O-BL

P901

R	TX A+ ▲	39
#8-BK	TX A- ▲	40
Y-BR	DC CONV CONT	1
Y-BL	RX MUTE	3
SHIELD	CONTROL A-	21
Y-GA	SPARE	5
SHIELD	MIC LO	2
22-BR	MIC HI	4
Y-R	SPARE	7
W-BR	FI	8
W-R	F2	9
W-BL	F3	10
W-V	F4	11
W-GA	F5	12
W-O	F6	13
W-Y	F7	14
Y-BK	F8	15
Y-V	BLKR DISABLE	26
R	IGN SW	24
W	PTT	25
O	SQ DISABLE	23
V	CAS	16
GA	SQ ARM	17
G	VOL/SQ HI	20
SHIELD	VOL/SQ LO	18
BL	VOL ARM	19
16-Y	A+	29
Y-G	RX PA	22
16-BK	A-	30
16-BR	SPKR LO	27
16-G	SPKR HI	28
W-G	CG DISABLE	6
Y	F9 *	31
G	F10 *	32
W	SPARE *	33
SHIELD	SPARE *	34
O-BR	F11 *	35
O-R	F12 *	36
O-G	SPARE *	37
O-BL	SPARE *	38

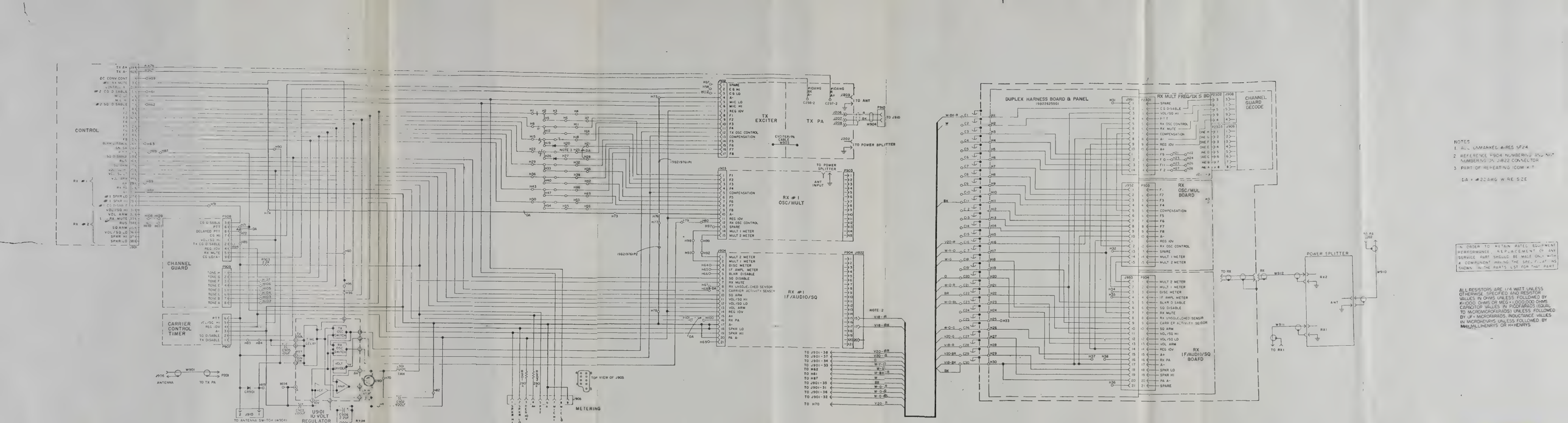
NOTES:
ALL WIRES #24 UNLESS OTHERWISE NOTED
* THESE WIRES PRESENT IN 38 (INCLUSIVE) CABLE ONLY
● #8 EXCEPT 9-FOOT CABLES ARE #24
▲ RED AND BLACK TX LEADS ARE NOT CONNECTED FOR NEGATIVE GROUND. FOR POSITIVE GROUND, CONNECT RED LEAD TO P901-40 AND BLACK TO P901-39.

REV NO.

1	A Cramer Oct. 21, 75	R&C	PRINTS TO L38
	RETR FOR I.B. NOCHNG		
2	A Cramer Oct. 27, 75	R&C	

DR B.P. ADAMS AUG. 72 | J.E. LOYD 8-30-72 | MAPO CV DEPT | LYNCHBURG, VA LOCATION | 19C321784 CONT ON SHEET SH NO.

EC-4


CONTROL
CHANNEL GUARD
CARRIER CONTROL TIMER
TX EXCITER
TX PA
RX #1 OSC/MULT
RX #1 IF/AUDIO/SQ
DUPLEX HARNESS BOARD & PANEL
RX MULT FREQ/DX 5 BD
CHANNEL GUARD DECODE
RX OSC/MUL BOARD
RX IF/AUDIO/SQ BOARD
POWER SPLITTER
U901 10 VOLT REGULATOR
METERING
ANTENNA
TO TX PA
TO ANTENNA SWITCH (A904)
TO ANT
TO J910
TO POWER SPLITTER
TO RX
TO RX1
TO RX2
TO P3
ANT
NOTES
1. ALL UNMARKED WIRES 5PR24.
2. REFERENCE P904 NUMBERING AND NOT NUMBERING ON J1822 CONNECTOR
3. PART OF REPEATING ICOM KIT.
DA = #22AWG WIRE SIZE
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN IN THE PARTS LIST FOR THAT PART.
ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

WIRING DIAGRAM

DUAL RECEIVER MOBILE

(19R601095, Rev. 3)

DESCRIPTION
- - STORS - - - - - - - - -
0 ohms ±10%, 1/4 w.
0 ohms ±5%, 1/4 w.
F and earlier:
E and earlier:
0 ohms ±10%, 1/4 w.
0 ohms ±5%, 1/4 w.
D and earlier:
C and earlier:
00 ohms ±10%, 1/4 w.
film: approx 75 to 10,000 ohms to CTS Type X-201.
film: approx 200 to 5000 ohms to CTS Type X-201.
D and earlier:
C and earlier:
film: approx 2000 to 50,000 ohms to CTS Type X-201.
.000 ohms ±10%, 1/4 w.
A and earlier:
B and earlier:
000 ohms ±10%, 1/4 w.
ohms ±10%, 1/2 w.
E and earlier:
D and earlier:
ohms ±10%, 1/4 w.
0 megohm ±10%, 1/4 w.
7 megohm ±10%, 1/4 w.
000 ohms ±10%, 1/4 w.
000 ohms ±10%, 1/4 w.
000 ohms ±10%, 1/4 w.
000 ±10%, 1/4 w.
0 ohms ±10%, 1/4 w.
0 ohms ±10%, 1/4 w.
ohms ±10%, 1/4 w.
ohms ±10%, 1/4 w.
000 ohms ±10%, 1/4 w.
0 ohms ±10%, 1/4 w.
ohms ±10%, 1/4 w.
000 ohms ±10%, 1/4 w.
ohms ±10%, 1/4 w.
ohms ±10%, 1/4 w.
000 ohms ±10%, 1/4 w.
ohms ±5%, 1/4 w.
ohms ±10%, 1/4 w.
ohms ±10%, 1/4 w.
ohms ±10%, 1/4 w.
000 ohms ±10%, 1/4 w.
ohms ±5%, 1/2 w.
ohms ±5%, 1/2 w.
and earlier:
and earlier:
ohms ±10%, 1/4 w.
ohms ±10%, 1/4 w. Added to
ohms ±10%, 1/4 w. Added to Deleted in G5, G7 by REV C.
ohms ±5%, 1/4 w. REV F. REV E.

SYMBOL	GE PART NO.	DESCRIPTION
R155*	3R152P201J	Composition: 200 ohms ±5%, 1/4 w. Added to G5, G7 by REV F. Added to G6, G8 by REV E.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - -
T103	19D416843G1	Coil. Includes:
	5493185P12	Tuning slug.
T104	19D416843G3	Coil. Includes
	5493185P12	Tuning slug.
T105	19D416843G2	Coil. Includes:
	5493185P12	Tuning slug.
T106 and T107	19D416843G7	Coil. Includes
	5493185P12	Tuning slug.
T108 and T109	19D416843G5	Coil. Includes:
	5493185P13	Tuning slug.
T110		COIL ASSEMBLY 19D416843G8
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R152P151K	Composition: 150 ohms ±10%, 1/4 w.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	5493185P13	Tuning slug.
T111	19D416843G4	Coil. Includes:
	5493185P12	Tuning slug.
T112	19D416843G6	Coil. Includes:
	5493185P12	Tuning slug.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
U101	19D416542G1	Audio Transmitter.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY101 thru XY108		Socket. Part of Mechanical Construction. Includes:
	19A116779P1	Contact, electrical: sim to Molex 08-54-0404. Quantity (6) with each.
		- - - - - - - - - - OSCILLATORS - - - - - - - - - -
		NOTE: When reordering specify ICOM Frequency.
		ICOM Freq = Operating Frequency 36
Y101 thru Y108	19A129393G18	Externally compensated, ±5 PPM, 406-512 MHz.
Y101 thru Y108	19A129393G15	Externally compensated, ±2 PPM, 406-512 MHz.
		MECHANICAL PARTS
	19A129424G2	Can. (Used with T103-T112).
	4036555P1	Insulator, washer: nylon. (Used with Q108, Q110).

Tx

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R101	3R152P561K	Composition: 560 ohms ±10%, 1/4 w.
R102*	3R152P431J	Composition: 430 ohms ±5%, 1/4 w.
		In G5, G7 of REV F and earlier: In G6, G8 of REV E and earlier:
	3R152P391K	Composition: 390 ohms ±10%, 1/4 w.
R103*	3R152P201J	Composition: 200 ohms ±5%, 1/4 w.
		In G5, G7 of REV D and earlier: In G6, G8 of REV C and earlier:
	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R104	19B209358P106	Variable, carbon film: approx 75 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R105*	19B209358P105	Variable, carbon film: approx 200 to 5000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
		In G5, G7 of REV D and earlier: In G6, G8 of REV C and earlier:
	19B209358P108	Variable, carbon film: approx 2000 to 50,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R106*	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
		In G5, G7 of REV A and earlier: In G6, G8 of REV B and earlier:
	3R152P393K	Composition: 39,000 ohms ±10%, 1/4 w.
R107*	3R77P331K	Composition: 330 ohms ±10%, 1/2 w.
		In G5, G7 of REV E and earlier: In G6, G8 of REV D and earlier:
	3R152P331K	Composition: 330 ohms ±10%, 1/4 w.
R110	3R152P104K	Composition: 0.10 megohm ±10%, 1/4 w.
R111	3R152P474K	Composition: 0.47 megohm ±10%, 1/4 w.
R125	3R152P102K	Composition: 101000 ohms ±10%, 1/4 w.
R126	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R127	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R128	3R152P683K	Composition: 69,000 ohms ±10%, 1/4 w.
R129	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
R130	3R152P562K	Composition: 5600 ohms ±10%, 1/4 w.
R131	3R152P471K	Composition: 470 ohms ±10%, 1/4 w.
R133	3R152P561K	Composition: 560 ohms ±10%, 1/4 w.
R134	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R135	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R136	3R152P470K	Composition: 47 ohms ±10%, 1/4 w.
R138	3R152P473K	Composition: 47,000 ohms ±10%, 1/4 w.
R139	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
R140	3R152P271K	Composition: 270 ohms ±10%, 1/4 w.
R141	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R142	3R152P620J	Composition: 62 ohms ±5%, 1/4 w.
R143	3R152P331K	Composition: 330 ohms ±10%, 1/4 w.
R144	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
R145	3R152P390K	Composition: 39 ohms ±10%, 1/4 w.
R146	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R148	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R149*	3R152P240J	Composition: 24 ohms ±5%, 1/2 w.
		In G5, G7 of REV B and earlier: In G6, G8 of REV A and earlier:
	3R152P100K	Composition: 10 ohms ±10%, 1/4 w.
R152*	3R152P391K	Composition: 390 ohms ±10%, 1/4 w. Added to G5 and G7 by REV A.
R153*	3R152P100K	Composition: 10 ohms ±10%, 1/4 w. Added to G5 and G7 by REV A. Deleted in G5, G7 by REV C.
R154*	3R152P241J	Composition: 240 ohms ±5%, 1/4 w. Added to G5, G7 by REV F. Added to G6, G8 by REV E.

SYMBOL	GE PART NO.	DESCRIPTION
R155*	3R152P201J	Composition: 200 ohms ±5%, 1/4 w. Added to G5, G7 by REV F. Added to G6, G8 by REV E.
		- - - - - - - - - - TRANSFORMERS - -
T103	19D416843G1	Coil. Includes
	5493185P12	Tuning slug.
T104	19D416843G3	Coil. Includes:
	5493185P12	Tuning slug.
T105	19D416843G2	Coil. Includes:
	5493185P12	Tuning slug.
T106 and T107	19D416843G7	Coil. Includes
	5493185P12	Tuning slug.
T108 and T109	19D416843G5	Coil. Includes:
	5493185P13	Tuning slug.
T110		COIL ASSEMBLY 19D416843G8
		- - - - - - - - - - RESISTORS - -
R1	3R152P151K	Composition: 150 ohms ±10%, 1/4 w.
		- - - - - - - - - MISCELLANEOUS - -
	5493185P13	Tuning slug.
T111	19D416843G4	Coil. Includes:
	5493185P12	Tuning slug.
T112	19D416843G6	Coil. Includes:
	5493185P12	Tuning slug.
		- - - - - - - - INTEGRATED CIRCUITS -
U101	19D416542G1	Audio Transmitter.
		- - - - - - - - - - SOCKETS - - - -
XY101 thru XY108		Socket. Part of Mechanical Construct
	19A116779P1	Contact, electrical: sim to Molex 0 Quantity (6) with each.
		- - - - - - - - - - OSCILLATORS - -
		NOTE: When reordering specify ICOM
		ICOM Freq = Operating Frequency / 36
Y101 thru Y108	19A129393G18	Externally compensated, ±5 PPM, 406-5
Y101 thru Y108	19A129393G15	Externally compensated, ±2 PPM, 406-
		MECHANICAL PARTS
	19A129424G2	Can. (Used with T103-T112)
	4036555P1	Insulator, washer: nylon. (Used w Q110).

SYMBOL	GE PART NO.	DESCRIPTION
C137M*	5496219P251	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -80 PPM. Added to G5 and G7 by REV A.
C138	5491601P115	Phenolic: 0.56 pf ±5%, 500 VDCW.
C139L	5496219P247	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -80 PPM.
C139H	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C140	5496219P348	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -150 PPM.
C141	5490008P127	Silver mica: 100 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C142	7489162P25	Silver mica: 82 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C143	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C144L*	5496219P243	Ceramic disc: 13 pf ±15%, 500 VDCW, temp coef -80 PPM.
		In G5 and G7 earlier than REV A:
	5496219P244	Ceramic disc: 15 pf ±15%, 500 VDCW, temp coef -80 PPM.
C144H	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C145*	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM. Deleted in G5 and G7 by REV A.
C145L*	5496219P252	Ceramic disc: 36 pf ±5%, 500 VDCW, temp coef -80 PPM. Added to G5 and G7 by REV A.
C145H*	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM. Added to G5 and G7 by REV A.
C146*	5491601P113	Phenolic: 0.47 pf ±5%, 500 VDCW. Deleted in G5 and G7 by REV A.
C146L*	5491601P109	Phenolic: 0.33 pf ±5%, 500 VDCW. Added to G5 and G7 by REV A.
C146H*	5491601P113	Phenolic: 0.47 pf ±5%, 500 VDCW. Added to G5 and G7 by REV A.
C147L	5496219P239	Ceramic disc: 8.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C147H	5496219P236	Ceramic disc: 5.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C148	5491601P111	Phenolic: 0.39 pf ±5%, 500 VDCW.
C149L	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C149H	5496219P237	Ceramic disc: 6.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C150	5496372P365	Ceramic disc: 470 pf ±10%, 500 VDCW, temp coef -4700 PPM.
C151	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C152	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C153	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C154L	5496219P238	Ceramic disc: 7.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C154H	5496219P236	Ceramic disc: 5.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C155L*	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM. Deleted in G5, G7 by REV C.
C155H*	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM. Deleted in G6, G8 by REV B.
C156	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C157L*	5496219P238	Ceramic disc: 7.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM. Deleted in G5, G7 by REV C.
C157H*	5496219P236	Ceramic disc: 5.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM. Deleted in G6, G8 by REV B.
C158	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C159*	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
		In G5, G7 of REV D and earlier: In G6, G8 of REV C and earlier:
	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.

SYMBOL	GE PART NO.	DESCRIPTION
C161L*	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp -80 PPM. Added to G5, G7 by REV C.
C161H*	5496219P242	Ceramic disc: 12 pf ±5%, 500 VDCW, temp -80 PPM. Added to G6, G8 by REV B.
C162L*	5496219P238	Ceramic disc: 7.0 pf ±0.25 pf, 500 VDCW coef -80 PPM. Added to G5, G7 by REV C.
C162H*	5496219P235	Ceramic disc: 4.0 pf ±0.25 pf, 500 VDCW coef -80 PPM. Added to G6, G8 by REV B.
C163*	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; RMC Type JF Discap. Added to G5, G7 by REV D. Added to G6, G8 by REV C.
C164*	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to S Type 150D. Added to G5, G7 by REV F. Added to G6, G8 by REV E.
		- - - - - - - - DIODES AND RECTIFIERS - -
CR104 thru CR106	19A115250P1	Silicon.
CV103*	5495769P9	Silicon, capacitive: 33 pf ±20%, at 4 V Added to G5 and G7 by REV E. Added to G6 and G8 by REV D.
	5495769P8	Silicon, capacitive: 33 pf ±20%, at 4 V Deleted in G5-G8 by REV A.
CV103L*	5495769P9	Silicon, capacitive: 33 pf ±20%, at 4 V Added to G5, G7 by REV A. Deleted from by REV E.
CV103H*	5495769P8	Silicon, capacitive: 33 pf ±20%, at 4 V Added to G6, G8 by REV A. Deleted from by REV D.
		- - - - - - - - JACKS AND RECEPTACLES - -
J101	19A130924G1	Receptacle, coaxial: sim to Cinch 14H11
J103	19B219374G1	Connector. Includes:
	19A116651P1	Contacts, (9).
		- - - - - - - - - - INDUCTORS - - - - -
L102	19B209420P130	Coil, RF: 27.0 µh ±10%, 3.60 ohms DC r sim to Jeffers 441316-5.
L104	7488079P7	Choke, RF: 1.50 µh ±10%, 0.50 ohms DC r sim to Jeffers 4411-10K.
L105	7488079P18	Choke, RF: 15.0 µh ±10%, 1.20 ohms DC r sim to Jeffers 4421-9K.
L106	7488079P5	Choke, RF: 0.68 µh ±10%, 0.15 ohms DC r sim to Jeffers 4411-5K.
L108 and L109	19B209420P123	Coil, RF: 6.80 µh ±10%, 1.80 ohms DC r sim to Jeffers 4446-2.
		- - - - - - - - - - - PLUGS - - - - - -
P902		Includes:
	19B219594P2	Contact strip: 8 pins.
	19B219594P3	Contact strip: 9 pins.
		- - - - - - - - - TRANSISTORS - - - - -
Q101*	19A115330P1	Silicon, NPN.
		In G5, G7 of REV A and earlier: In G6, G8 of REV B and earlier:
	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q104 thru Q106	19A115330P1	Silicon, NPN.
Q107	19A115328P1	Silicon, NPN.
Q108	19A115329P2	Silicon, NPN.
Q109*	19A115329P2	Silicon, NPN. Deleted in G5, G7 by REV C. Deleted in G6, G8 by REV B.
Q110*	19A116868P1	Silicon, NPN; sim to Type 2N4427. Added to G5, G7 by REV C. Added to G6, G8 by REV B.

CHANGES

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Exciter Board 19D416859G5, G7. To improve operation. Deleted C136L. Changed C136H, C137, C144L, C145, C146, CV103. Added C137L, C145L, C146L, CV103L, L108, R152 and R153.

REV. B - To improve drive to modulator. Changed Q101 and R106.

REV. C - To increase power output and decrease transmitter noise. Changed Q109, R149 and C109. Deleted R153, C155L and C157L. Added C161L and C162L.

REV. D - To improve modulator limiting. Deleted C109 and added C163.

REV. E - To improve operation. Changed CV101, CV102, CV103, C159 and R105.

REV. F - To reduce alternator noise and to improve operation. Changed R107 and Added R155, R154 and C164.

REV. G - To increase audio sensitivity. Changed R102.

REV. A - Exciter Board 19D416859G6, G8. To improve drive to modulator. Changed Q101 and R106.

REV. B - To increase power output and reduce transmitter noise. Changed Q109, R149, and C109. Deleted C155H and C157H. Added C161H and C162H.

REV. C - To improve modulator limiting. Deleted C109 and added C163.

REV. D - To improve operation. Changed CV101, CV102, CV103, C159 and R105.

REV. E - To reduce alternator noise and improve operation. Changed R107 and added R154, R155 and C164.

REV. F - To increase audio sensitivity. Changed R102.

PARTS LIST

LBI-4609C

406-420 MHz, 450-512 MHz EXCITER BOARD
19D416859G5-G8

SYMBOL	GE PART NO.	DESCRIPTION
		19D416859G5 2 FREQ 406-420 M 19D416859G6 2 FREQ 450-512 M 19D416859G7 8 FREQ 406-420 M 19D416859G8 8 FREQ 450-512 M
		- - - - - - - - - CAPACITORS - - - -
C101 and C102	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C103	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C104	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim Type 150D.
C105	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim Type 150D.
C106	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim Type 150D.
C107	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C108	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDC RMC Type JF Discap.
C109*	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW. D G7 by REV D; G6, G8 by REV C.
		In G5, G7 of REV B and earlier: In G6, G8 of REV A and earlier:
	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDC RMC Type JF Discap.
C110	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDC RMC Type JF Discap.
C112	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDC RMC Type JF Discap.
C118	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDC RMC Type JF Discap.
C123 thru C125	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDC RMC Type JF Discap.
C126	7489162P27	Silver mica: 100 pf ±5%, 500 VDCW; s Electro Motive Type DM-15.
C127	19A116080P107	Polyester: 10 µf ±10%, 50 VDCW.
C129 and C130	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDC RMC Type JF Discap.
C131L	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, t -80 PPM.
C131H	5496219P248	Ceramic disc: 24 pf ±5%, 500 VDCW, t -80 PPM.
C132	5491601P118	Phenolic: 0.75 pf ±5%, 500 VDCW.
C133L	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, t -80 PPM.
C133H	5496219P248	Ceramic disc: 24 pf ±5%, 500 VDCW, t -80 PPM.
C134	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C135	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
C136*	5496219P246	Ceramic disc: 20 pf ±5%, 500 VDCW, t -80 PPM. Added to G5 and G7 by REV A.
C136L*	5496219P348	Ceramic disc: 24 pf ±5%, 500 VDCW, t -150 PPM. Deleted from G5 and G7 by R
C136H*	5496219P246	Ceramic disc: 20 pf ±5%, 500 VDCW, t -80 PPM. Deleted from G5 and G7 by RE
C137*	5496219P251	Ceramic disc: 33 pf ±5%, 500 VDCW, t -80 PPM. Deleted from G5 and G7 by RE
C137L*	5496219P254	Ceramic disc: 43 pf ±5%, 500 VDCW, t -80 PPM. Added to G5 and G7 by REV A.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION

SYMBOL	GE PART NO.	DESCRIPTION
		NOTE: FOR HIGH SIDE INJECTION FREQUENCY.
		ICOM Freq = Operating Freq + 11.2 / 27
Y401 thru Y408	19A130283G6	Compensated: ±5 PPM, 406-420 MHz, 450-512 MHz.
	19A130283G4	Externally Compensated: ±5 PPM, 406-512 MHz.
	19A130283G2	Compensated: ±2 PPM, 406-512 MHz.
		UHS RF PRE-AMPLIFIER 19C320527G1 (LL) 19C320527G2 (L) 19C320527G3 (M) 19C320527G4 (H)
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C2301	19A116656P3J8	Ceramic disc: 3 pf ±0.1 pf, 500 VDCW, temp coef -80 PPM.
C2302	19A116679P220K	Mica: 220 pf ±10%, 250 VDCW.
C2303	19A116656P18J8	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -80 PPM.
C2305	19A116656P20K0	Ceramic disc: 20 pf ±10%, 500 VDCW, temp coef 0 PPM.
C2306	19A116679P100K	Mica: 100 pf ±10%, 250 VDCW.
C2307 and C2308	19A116679P220K	Mica: 220 pf ±10%, 250 VDCW.
C2309	19A116656P30J8	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM.
C2310	19A116656P20K0	Ceramic disc: 20 pf ±10%, 500 VDCW, temp coef 0 PPM.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J2301	19A116832P1	Receptacle, coaxial: sim to Cinch 14H11613.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L2301LL	19D413078G3	Helical resonator.
L2301L	19D413078G5	Helical resonator.
L2301M	19D413078G6	Helical resonator.
L2301H	19D413078G7	Helical resonator.
L2302	19A129716G1	Coil.
		- - - - - - - - - - - PLUGS - - - - - - - - - -
P2301	4029340P2	Contact, electrical: sim to Amp 42827-2.
P2302		(Part of W2301).
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q2301	19A116859P1	Silicon, NPN; sim to Type 2N5032 or 2N3570.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2301	3R152P153K	Composition: 15,000 ohms ±10%, 1/4 w.
R2302	3R152P682K	Composition: 6800 ohms ±10%, 1/4 w.
R2303	3R152P561K	Composition: 560 ohms ±10%, 1/4 w.
R2304	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W2301	5491689P94	RF: approx 3 inches long. Includes P2302.
		- - - - - - **MISCELLANEOUS** - - - - - -
	19E501121P1	Casting, RF Circuit.
	19C320455P1	Cover, RF Circuit.
	19B219886P1	Cover. (Located over A303-C2).
	19B209209P304	Tap screw, Phillips Pozidriv : No. 6-32 x 1/4. (Secures RF Circuit Cover).
	4036765G11	Screw. (Part of C301-C305).
	4036765G12	Screw. (Part of C306-C308).

SYMBOL	GE PART NO.	DESCRIPTION
	7137968P8	Nut, stamped: thd size No. 6-32; sim to Palnut T0632005. (Part of C301-C308).
	19B219470P2	Shield. (Used with IF Filter Board).
	19A129424G1	Can. (Used with L401-L403, L501, L503, L504).
	19A127060P2	Can. (Used with L2301).
	4035306P59	Washer, fiber. (Used with FL501, FL502).
	19A129715G1	Adapter Board. (Carries IF from IF Filter Board to IFAS Board).
		RECEIVER MODIFICATION KIT 19A129750G1 (Used with DUAL FRONT END)
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR2301	19A116925P1	Silicon.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R2301	3R152P223J	Composition: 22,000 ohms ±5%, 1/4 w.
R2302	3R152P681K	Composition: 680 ohms ±10%, 1/4 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W2301	19B219999G2	RF: approx 10-1/2 inches long.
		DUAL FRONT END MODIFICATION KIT 19A129750G2
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR2301	19A116925P1	Silicon.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R2301	3R152P223J	Composition: 22,000 ohms ±5%, 1/4 w.
R2303	3R152P911J	Composition: 910 ohms ±5%, 1/4 w.

12x

CONTROLLER

TONE

&

SIGNALLING

BACKDOOR ENTRY IF CODE LOST: HOLD 4 & 8 KEYS, HIT ENTER
WILL GO INTO PROGRAMMING MODE, THEN MUST HIT 09 ENTER AND
NEW LAST TWO DIGITS OF PROGRAMMING CODE DESIRED

INPUT VOLTAGE: APPROXIMATELY 1Mv TO MAX OF 1V PP

U18 AND U19 HOLD MEMORIES
WILL GO BAD AFTER 10K HOURS USE
INDICATIONS: WILD THINGS HAPPENING
DROP TONES
JUNK COMING OUT
LOTS GARBAGE
ACTIVATES TONES

PART: XD2212
GE #: 19A703072P2
MUST REPLACE AS PAIR
MUST BE ON MINIMUM OF FOUR HOURS (4) BEFORE WILL HOLD MEMORY
IF CHANGED, POWER TURNED OFF, UNIT MOVED, THEN POWER ON WILL
HAVE TO BE RE-PROGRAMMED

TALKED TO NICK N0CYT AT FACTORY IN WASHINGTON

WIRING

&

INTERCONNECTIONS

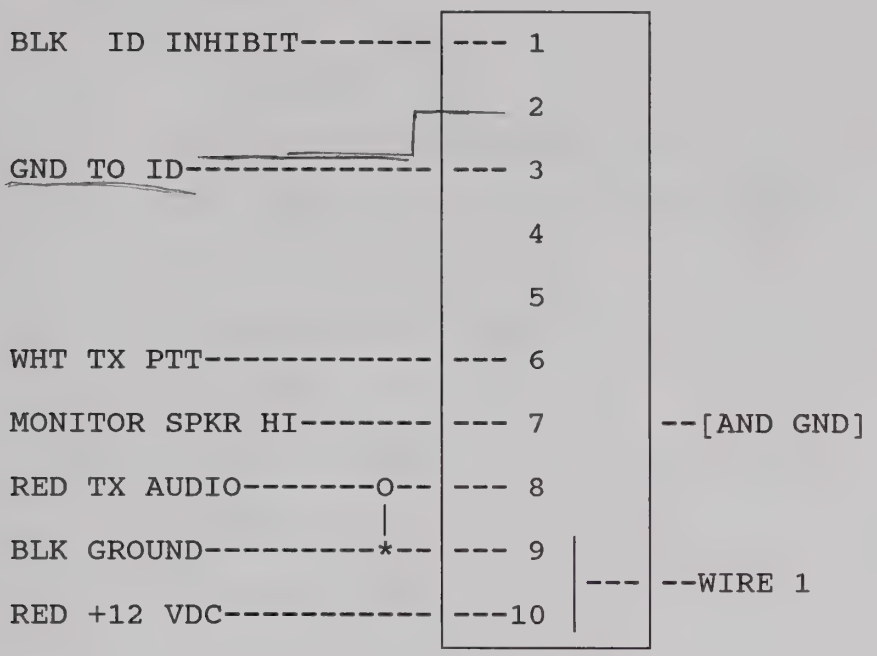
REPEATER INTERCONNECTION WIRING

RECEIVER #1		TB702	WIRE FROM RADIO
MIC CONN & CSI-32	PTT	1	WHITE
MIC CONN	MIC HI	2	22-BRN
MIC CONN & CSI-32	MIC LO	3	SHIELD
SPKR SWITCH	SPKR HI	4	GREEN
SPKR SWITCH	SPKR LO	5	BROWN
Y/RED WHT/BLU	VOL-SQ LO	6	SHIELD
W/BRN	SQ ARM	7	GREY
Y/VIO	VOL ARM	8	BLUE
Y/GRY WHT/GRN	VOL-SQ HI	9	GREEN (.068mf)
	DISC INPUT TO CSI-32	10	(JUMPER TO 9)
	GND	11	16-BLACK W/BRN W/GRN
	+12V	12	16-YELLOW

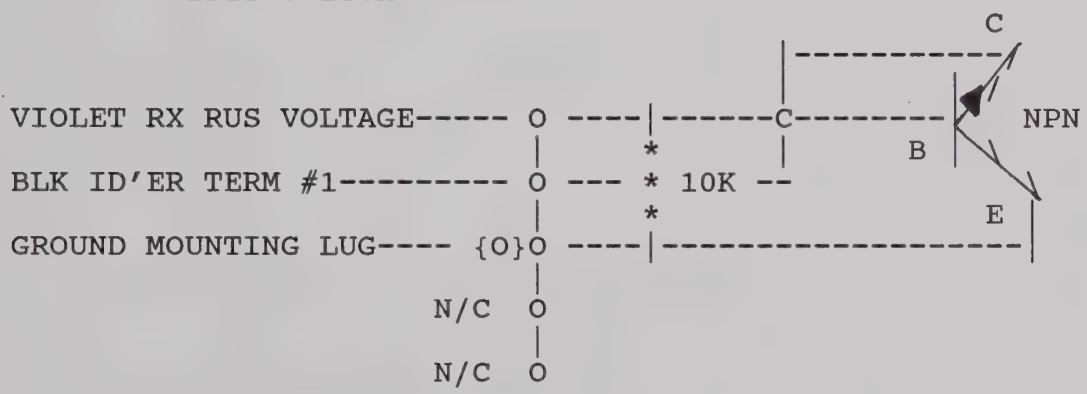
		1	
		2	
		3	
SPKR SWITCH	SPKR HI	4	ORG/GRN
SPKR SWITCH	SPKR LO	5	ORG/BLU
O/BL WHT/RED	VOL-SQ LO	6	SHIELD
W/YEL	SQ ARM	7	ORANGE
G/WHT	VOL ARM	8	RED
O/GRN W/VIO	VOL-SQ HI	9	BROWN (.068mf)
GREEN	COS TO CSI-32	10	[illegible]
	GND	11	
	+12	12	

RECEIVER #2 TB703 WIRE FROM RADIO

REPEATER ID'ER CONNECTIONS



ID INHIBIT SWITCH



CSI-32 CONTROLLER CONNECTIONS

DB-9 CONNECTOR

1 - +12VDC (RED)

2 - AUDIO OUT TO TRANSMITTER (GREY)

3 - INPUT FROM RCVR DISCRIMINATOR (BROWN)

4 - SITE ALARM (N/C)

5 - TRANSMITTER PTT (BLUE)

6 - COS INPUT (GREEN)

7 - GROUND (SHIELDS)

8 - GROUND (SHIELDS)

9 - SUBAUDIBLE TONE OUTPUT

POWER STRIP CONNECTIONS

A - RADIO

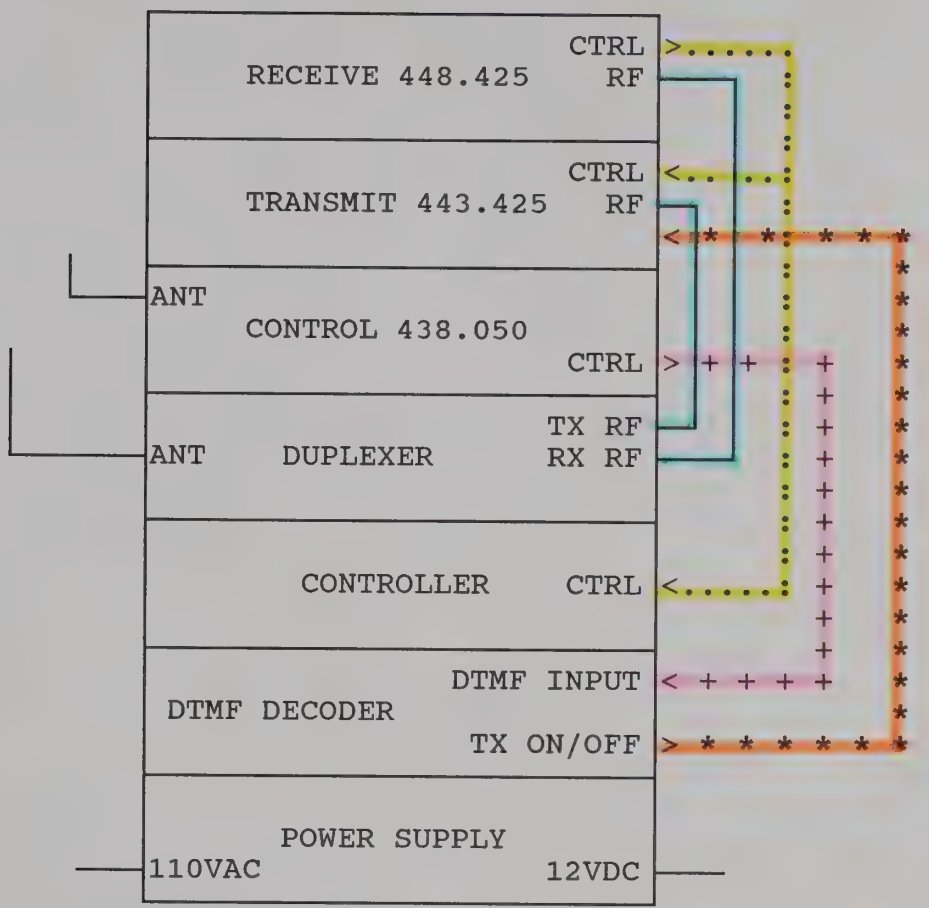
B - CSI-32 CONTROLLER

C - ID'ER

CSI-32 CONTROLLER ACCESS CODE

356D9

UHF REPEATER BLOCK DIAGRAM



UHF REPEATER DESIGN
RX: 448.425 TX: 443.425
PL TONE: 127.3 HZ
12-03-90 BY W7AZF